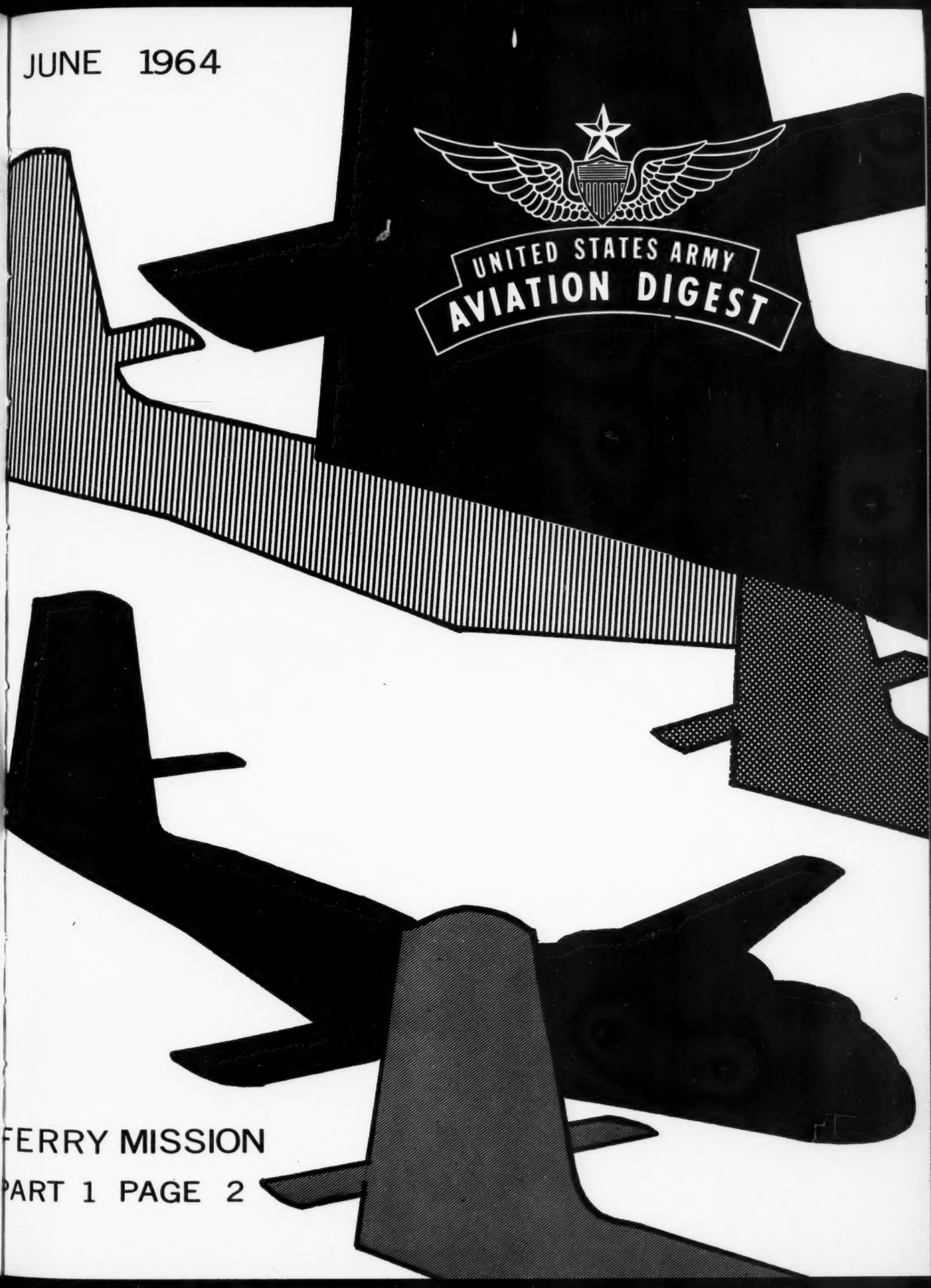
JUNE 1964



FERRY MISSION

PART 1 PAGE 2

UNITED STATES ARMY AVIATION DIGEST

JUNE 1964 VOLUME 10 NUMBER

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The mission of the U. S. ARMY AVIATION DIGEST is to provide information of a operational or functional nature concerning safety and aircraft accident prevention, training, maintenance, operations, research and development, aviation medicine, and other related data.

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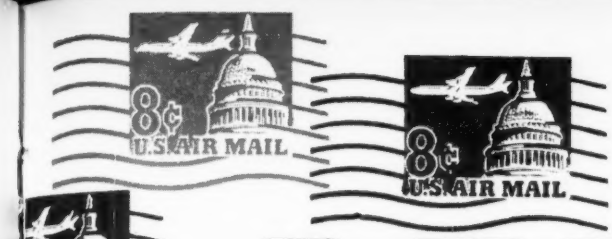


LETTERS

Sir:

In the Crash Sense article of the December 63 issue there was an accident brief titled "Planned Event." The story concerned a pilot killed while participating at a civilian air show, when the authority granted stipulated the three 0-1As involved were to be placed in static display only.

There were additional factors contributing to the tragedy which most probably never were included in the accident report, yet provided a fatal background.

The unit to which the three pilots were assigned had about six months previously been engaged in a large scale maneuver. As a result the division was out of money (Avgas) and flying was mighty scarce. Four hours a month was not uncommon, and the fact that the unit was about 90 percent overstrength in pilots didn't help. The old not so bold pilots seemed to take short flying rations without too much trouble, but the fresh low-hour people were anxious to fly anywhere, anytime. The long periods between flights hung pretty heavy; there were a dozen volunteers for every mission. To compound the situation was the maneuver previously mentioned. Then everybody was flying under all kinds of terrain and weather with the resultant sharpening of proficiency. Proficiency which was lost during the dry spell, although some of the aviators hadn't enough experience to realize it.

The stage was set. The assistant operations officer called two 2/Lt pilots, asking if they wanted to fly with him in an air show the following day. It was fortunate that one or both of the other aircraft didn't stall and crash during the fancy low-level pitchout, as did that of the flight leader.

The story didn't end with the loss of pilot and aircraft. The two surviving pilots were court martialed, found guilty, and fined. They contended they knew nothing other than what they had been told by the deceased flight leader, assistant operations officer.

"Planned Event" was a most apt title. The fatal flight could not have been planned more effectively by commission than it was by omission.

JOHN H. WALKER
Capt Inf-USAR
ADOLPHUS A. MILLINGS
Capt TC-USAR

The book is wrong — we do it this way!!!

Sir:

Every Army Aviation unit has its own standardization program. Unfortunately they are almost all different. We at Redstone feel that the sole basis for standardization of aircraft operating procedures should be the aircraft operator's handbook, -10. The information published in the -10 was painstakingly obtained from a wealth of experience which almost always exceeds that of the using unit. We at Redstone have as much light or twin experience as any other unit, and we feel that we can live with the books. To those who can't or won't, we say, change 'em!

A major point of contention is power settings. As an example, let's look at climb or cruise power settings for the U-8. Many units incorrectly use 3000 rpm and 40" mp for climb. A check with the -10 shows this power setting exceeds manifold pressure limits at altitudes above 500 feet. Moreover, this power setting has never been engineer-tested as has the proper power setting, 100 percent meto power, 3200 rpm and 45" mp at sea level, diminishing at 42" mp to 10,000 feet.

For units using cruise power settings at 2600 rpm and 32" mp, may we again suggest a check with the -10. Use of cruise power charts can prevent unintentional overboost of manifold pressure limits, or on the other hand increase true airspeed by up to 8 knots. For example, the U-8F at 2600 rpm pulling 65 percent power can often be operated in excess of 34" mp, the extra 2 plus inches giving more than 5 knots extra TAS. In other flight conditions 32" mp might well exceed mainfold pressure limits, not dangerously, but enough to cause cumulative stress on the engines.

The generally higher power settings recommended not only have been manufacturer-recommended but experience has shown that these power settings have not caused engine failures. A Redstone U-8 has been flown more than 1,500 hours (148 hours in one month). Most of this time was flown with book-recommended power settings.

The failure to use meto power for climbout at low altitudes may well prove the old saying "Save the engines and ruin the aircraft" to those not lightning fast on single-engine procedure.

The use of the -10 for standardization procedures in every unit throughout the Army should help eliminate accidents due to faulty procedures — and the explanation that usually goes with it, "I know it isn't in the -10, but that's the way the IP told us to do it."

If you want to change the -10, send your gripe to:

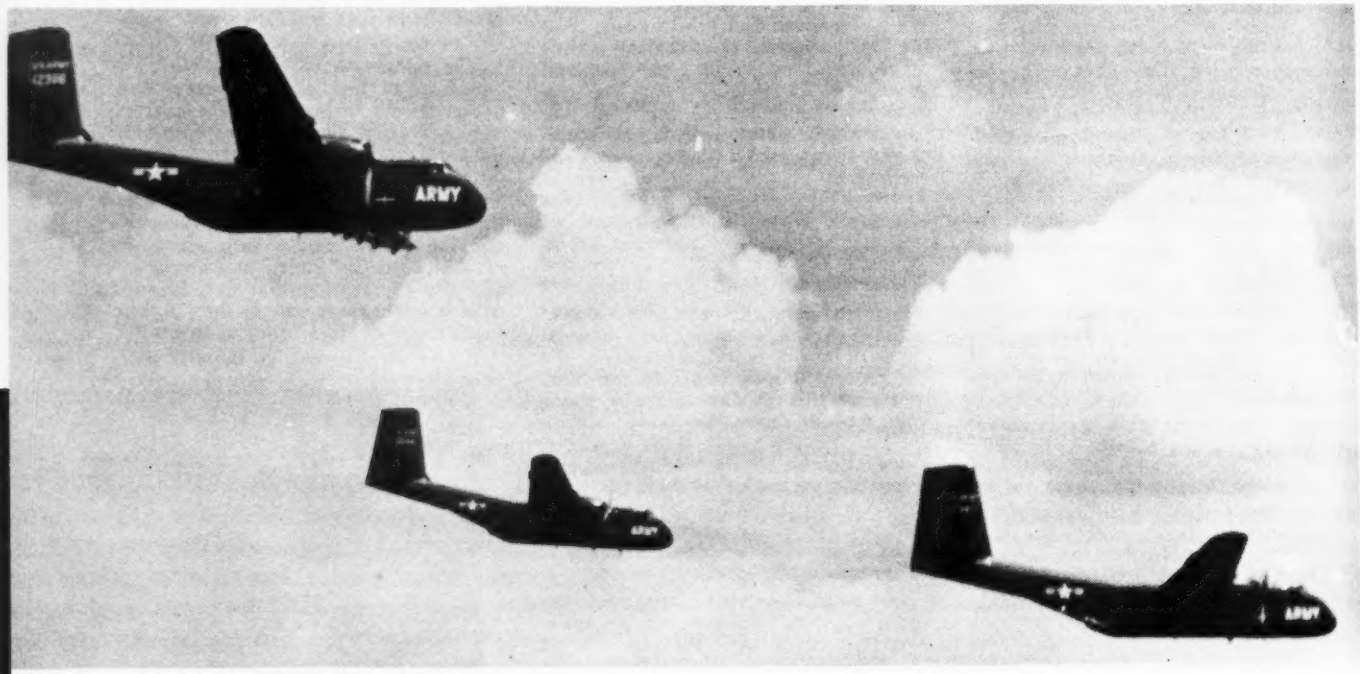
U. S. Army Aviation and
Surface Materiel Command
Main Post Office Box 209
St Louis, Missouri

PAUL LENNON
Capt Inf
Aviation Branch
AMSC Transportation Division
U. S. Army Missile Command
Redstone Arsenal, Alabama

Major William G. Hooks and Captain Ernest A. Smart

Ferry Mission-P

This article (printed in two parts) offers guidelines which may be helpful to units ordered to deploy one or more aircraft overseas. It is of special significance to Army Aviators, since Army aircraft have shorter ranges than those of other services and consequently must stop at foreign civil airports. Information contained is based primarily on the deployment of the 1st Aviation Company to the Far East, but also includes data obtained from records of previous ferrying missions and from discussions with aviators having personal experience in this type of operation.



on-Part One)

UPON RECEIVING orders to deploy a unit's aircraft overseas, certain responsibilities should be delegated to key personnel. A *flight leader* should be appointed. He should be senior in rank, highly experienced, and if possible have completed a similar mission previously. All final decisions will be made by him. A competent *assistant flight leader* also should be named. Other key personnel include:

- The *flight planning officer,* who will prepare a navigation log to be used as a basic plan for the completion of the mission. He also provides navigational charts, coordinates weather and flight plan briefings, determines fuel loads based on International Civil Aviation Organization (ICAO) minimums, and establishes and accomplishes inflight revisions of points of no return.
- The *maintenance officer,* who advises the flight leader of the status of all aircraft, ensures that maintenance requirements are met, and coordinates solutions of all maintenance problems.
- The *refueling officer,* who procures POL products and supervises the servicing of all aircraft so that it is done safely and expeditiously.
- The *transportation officer,* who arranges transportation for all crewmembers to and from mess facilities, billets, and other points of interest or welfare. At civilian fields in foreign countries transportation is best obtained through the American embassy.
- The *communications officer,* who sends required arrival and departure messages and coordinates all other communications needed to complete the mission.
- The *passport officer,* who ensures that all passports and visas are in order. Visas are subject to change and a check should be made with American embassies en route.
- The *customs officer,* who must be familiar with regulations outlined in the Foreign Clearance Guide (which can be obtained from the U. S. Army Information Flight Office, Washington 25, D. C.). He can anticipate vigorous inspections at certain ports of entry and should have all members of the flight thoroughly briefed on customs procedures.

With the appointment of the control officers listed above, the alerted unit should direct its efforts toward training. As in any other case, if adequate training is accomplished, the likelihood of a successful mission is greatly enhanced. Important subjects to cover while training for overseas deployment include navigation, performance charts, ATC procedures, survival and rescue procedures, etc.

The crewmembers of an overseas flight also should know something about customs in countries they will visit. When personnel are to stay in a country for an extended period, training should cover history, culture, transportation systems, communications systems, religious history, terrain, weather, and similar subjects. Much of this information can be found in the Foreign Clearance Guide.

PLANNING FACTORS

As in most situations involving deadlines, the principle of backward planning applies to the

Ferry Mission — (Part One)

ferry mission. The flight commander should prepare a checklist similar to that shown in figure 1. It might also be advisable at that time to appoint a liaison officer to work with higher headquarters. If time is not a critical factor, a liaison officer might not be needed.

During the initial planning phase it must be determined if all of the aircraft will be moved at once, or in flights, or as single aircraft at certain intervals. Where a large number of aircraft are concerned it is usually best to break the company down into flights. Under VFR conditions the size of each flight has little meaning. If a loose formation is flown, the fatigue factor is negligible. It is under IFR conditions that problems arise. When the remotest possibility of IFR conditions exists, an instrument flight plan should be filed before departure. This means aircraft will depart at intervals.

If IFR conditions are encountered while in flight in formation, a prepared SOP should be followed. A formation of five or fewer aircraft in actual instrument flight is feasible. An escort aircraft with monitoring radar can control a small flight under IFR conditions.

Even with the most modern forecasting facilities, weather changes en route can be much worse than forecast. Flights proceeding on a VFR flight plan can run into IFR conditions beyond the point of no return and when an ATC agency is not available to provide an IFR clearance. *The flight must resort to a prepared plan that will allow it to proceed.*

Personnel comfort is an important factor to consider before departure. When space and mission permit, extra crewmembers should be carried to help spread and lighten the workload — thereby reducing the fatigue factor.

When Caribou are ferried, it is recommended that two crewchiefs be carried. This results in more expeditious handling of postflights, security assignments, refueling, maintenance and similar requirements.

On accelerated moves, three pilots should be assigned each aircraft. This allows one to rest while two fly and also covers the eventuality of one becoming ill — a problem encountered on previous ferry missions when only two pilots were assigned to each aircraft. If extra pilots are unavailable, a list of Army Aviators stationed along the intended routes and qualified in the aircraft being ferried should be prepared before departure.

Lengths of flight legs vary among missions. But various plans should be carefully considered. For example, compare the 8-hour flight, 6-hour rest plan with the 6-hour flight, 4-hour rest plan. Over a 70-hour period the 6-4 ratio gets you to your destination 2 hours sooner, but it also has disadvantages. While the 6-hour flight leg is good to prevent fatigue, the 4-hour rest period proves inadequate on a long ferry mission. Upon landing, aircraft must be refueled, crews fed, and at some ports rigorous customs inspections encountered. This usually leaves less than 3 hours for rest and sleep. The 8-6 ratio generally allows at least 4 hours of rest.

Obviously, one ratio could never be strictly maintained during an entire ferry mission, but it is wise to pick one and follow it as closely as possible.

Latrine facilities are among the more important factors to consider while planning for personnel comfort. Because of its size, the Caribou can accommodate portable toilet facilities. On previous flights crewmembers suffered unmercifully with diarrhea and dysentery, the primary causes of discomfort on long ferry missions. While latrine facilities mean additional weight, they result in a more alert crew and enhanced safety of flight. Obviously, certain Army aircraft cannot carry latrine facilities, but anything that can serve the same purpose is desirable.

Examples of other items that make a more restful and safe flight (or that can be used in event of emergency) include cans of fresh water, C-rations, sleeping bags, air mattresses, and Thermos jugs.

A *must* in the planning of a ferry mission is the Foreign Clearance Guide. Available in classified and unclassified editions, it contains such information as how to obtain permission to enter, land within, or overfly countries; a list of foreign clearing bases; instructions relative to the need of passports and visas; money exchange procedures; disinsectization procedures; and medical immunization requirements.

Part II of this article will be printed in the July DIGEST. It provides pertinent information on maintenance, navigation, communications, rescue and survival, medical considerations, and other helpful hints of value to all Army Aviation units with a ferry mission. — Editor

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Maj Hooks is CV-2B Flight Commander, Dept of Advanced Fixed Wing Training, USAAVNS. Capt Smart is attending the Armor Advanced Course, Ft Knox, Ky.

CAUTION

Aviators who are SCUBA divers are cautioned that it is hazardous to fly at altitude soon after diving. Decompression symptoms are likely to occur during transition from pressures above one atmosphere to pressures below one atmosphere. It is recommended that aviators not fly above 5,000 feet altitude within 24 hours of diving to depths below 30 feet (plus 1 atmosphere), or within 12 hours of diving to depths below 15 feet.

SPECIAL AIR DELIVERY

Captain Charles E. Dexter

THE NEWEST and perhaps most effective method of delivering supplies and equipment from the CV-2B Caribou is the Low Level Extraction System of aerial delivery. The history of LOLEX dates back to June 1962 when Natick Laboratories, in conjunction with other interested Army agencies, conducted an evaluation of the Ground Proximity Extraction System (GPES), commonly called "Touch-and-Go" [See DIGEST, March 1963].

This system used a ground arresting cable and a hook trailing behind the aircraft. As the aircraft flew over the desired impact point on the ground, the hook made contact with the cable and snatched the load from the aircraft cargo compartment. This evaluation was terminated after several aircraft were damaged, and the system was deemed unsafe until some major changes could be made.

However, the advocates of GPES did not give up. They took their system to SWIFT STRIKE III in August 1963. Participating in the maneuvers was an Army officer, Capt John Murphy, with his detachment of riggers from the Quartermaster School, Fort Lee, Va., with some ideas and a system of their own — LOLEX.

Captain Murphy worked with the 187th

Capt Dexter is with the Employment Division, Dept of Tactics, USAAVNS.

An Army Aviator participating in SWIFT STRIKE III put new zip in the old saw, "You Call — We'll Haul." He used a new inflight low-level extraction system to deliver 5,000 pounds of cargo on three separate platforms in 7 seconds. Three minutes later the drop area was clear. What's behind such progress in resupply? Is the new technique simple? What about the landing area? Can LOLEX help your mission?

Medium Transport Airplane Company of the 11th Air Assault Division, Fort Benning, Ga., and demonstrated this new system. The following is an extract from Captain Murphy's after-action report listing some salient points of both the GPES and LOLEX systems.

(1)

GPES	LOLEX	
Yes	No	Needs ground arresting gear.
Yes	No	Needs qualified or specially trained personnel to operate the drop zone.
Yes	No	Must modify the airplane.
Yes	No	Needs at least 5 minutes between extractions.
Yes	Yes	Achieves pinpoint accuracy.
No	Yes	Can extract supplies with airplanes flying 1 minute apart.
Yes	No	Requires a great amount of pilot skill.
No	Yes	Is basically a standard system using standard equipment.
No	Yes	Can achieve multiple extractions in a single pass.
Yes	No	Causes concern about rough ground which may cause a premature extraction or malfunction.

(2) LOLEX requires a smaller drop zone than GPES.

(3) LOLEX can be used to great advantage when it is known that the airstrip to which supplies are to be delivered can handle only one airplane at a time.

(4) The Caribou can carry 6,000 pounds of supplies in 2,000-pound increments. It can extract all three increments in one place, or make two deliveries of 4,000 and 2,000 pounds, or three deliveries of 2,000 pounds each. Rerigging in flight for a second or third extraction takes approximately 7 minutes.

(5) The entire extraction kit for 6,000 pounds of supplies weighs 100 pounds. It can be carried in the lower escape hatch of the airplane and does not take up valuable cargo compartment space.

This comparison, coupled with the outstanding safety record of the 187th during SWIFT STRIKE III, drew much attention and interest in LOLEX. This interest was so keen that CONARC directed the United States Army Aviation School, Fort Rucker, Ala., to implement LOLEX into the Caribou Pilot Transition Course of instruction.

To date, the system has not been officially tested to determine its suitability for Army use; nor have standard procedures and techniques been developed, approved, or published. However, the Department of Tactics, U. S. Army Aviation School, and the Advanced Airborne Committee, U. S. Army Infantry School, have devised interim flight and rigging procedures for instructional purposes. The following discussion of LOLEX techniques and procedures is not in-

Figure 1. ¼-ton truck being extracted by 22-foot extraction parachute

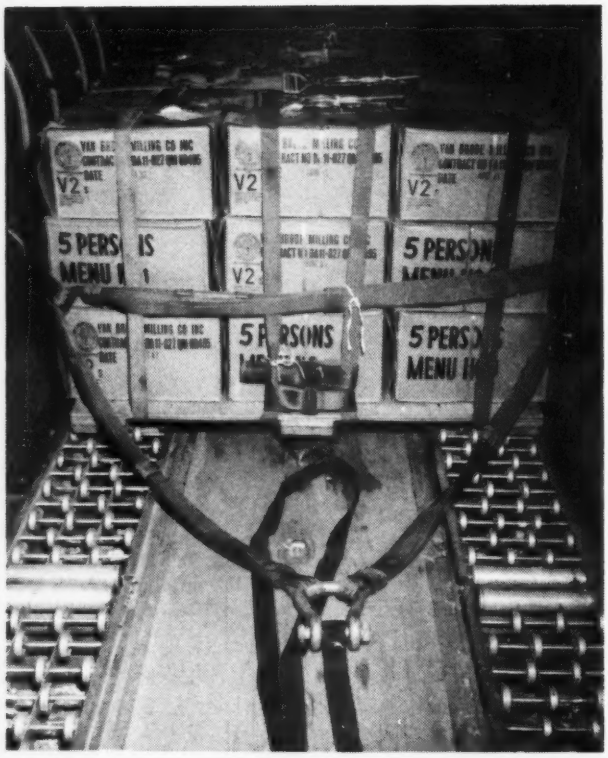


Figure 2. 4 x 8 skidboard on roller conveyers

Fig. 3. 500-gallon seal bin secured by tie-down devices

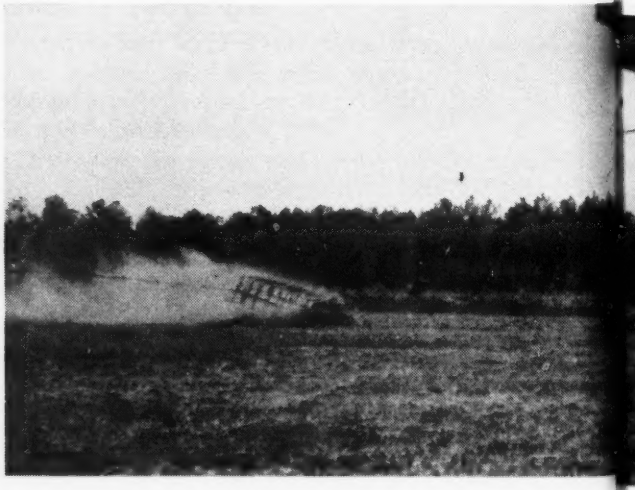
tended as final doctrine; it is an interim means of instruction until the U. S. Army Test and Evaluation Command, Aberdeen Proving Ground, Md., publishes its findings in the near future.

LOLEX is basically simple. The aircraft, with gear down, flaps in the 25° position, cargo ramp in the horizontal, is flown as close to the ground as possible at approximately 75 knots indicated airspeed (fig. 1). Loads up to approximately 3,000 pounds are extracted from the aircraft with a 15-foot, ring slot parachute. As the weight of the load increases, the size of extraction parachutes increases proportionately. The rigging is generally the same as for the heavy drop system, but eliminates the need for recovery (cargo) parachutes.

The aircraft is prepared for aerial delivery by installing the aerial unloading equipment, i.e., roller conveyers (fig. 2), side buffer boards, and, if available, forward buffer boards. The roller conveyers facilitate the moving of the load as it leaves the cargo compartment. The side buffer boards guide the load and prevent it from turning or snagging along the side of the interior. The forward buffer boards prevent the load from rolling forward after the tie-down devices have been removed just prior to delivery.

The supplies or equipment are attached to a combat expendable platform or skid board in the same manner as for any other type of aerial delivery role. The load is secured to the platform by straps and binders. When delivering vehicles or fragile items of equipment, honeycomb material is placed between the platform and critical points of the equipment. This honeycomb absorbs the shock of landing. (For detailed information on the preparing of platform loads refer to TM 10-500-5-4 & -5.)

LOLEX delivery of

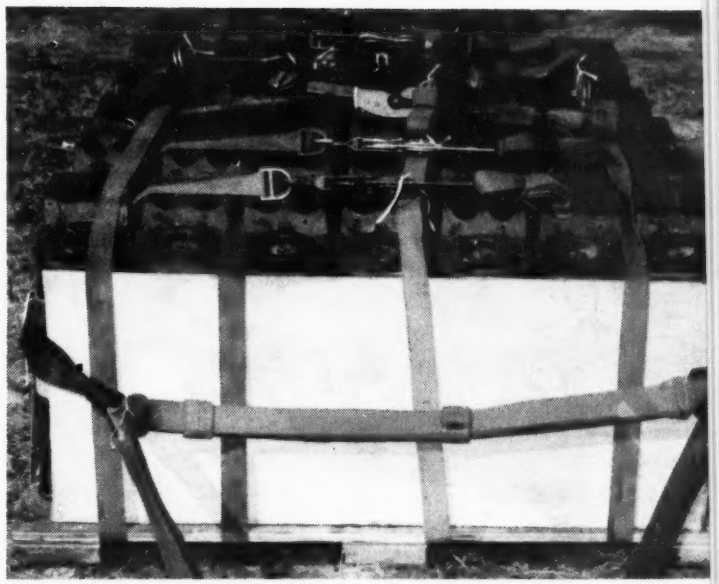


All air-delivered loads must be secured in the aircraft by tie-down devices for take off and flight (fig. 3). For loads to be extracted by LOLEX, an additional restraint system is used after the regular tie-down devices have been removed. A shear strap is installed at the aft end of the load to be extracted. It is attached to the rear of the platform and through the nearest tie-down ring on the floor of the cargo compartment. This final restraint is released when the extraction parachute deploys and begins to pull on the extraction line.

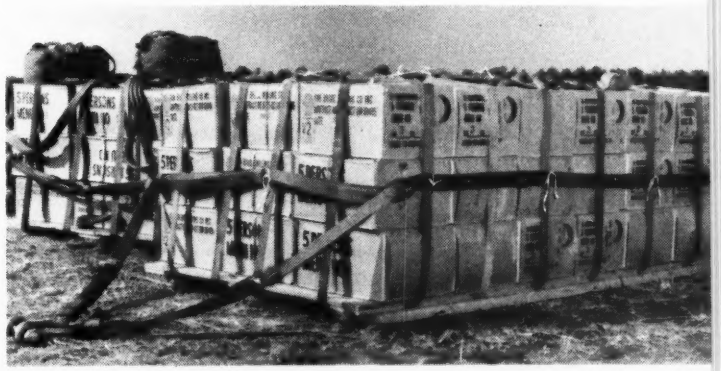
Actual extraction is accomplished by the action of an extraction parachute attached to the ejector rack in the ceiling of the cargo compartment of the aircraft. As the pilot passes over the designated spot on the ground, he activates the pendulum release switch located on the instrument panel. The extraction parachute then falls into the slipstream, deploys, cuts the final restraint, pulls the load from the aircraft, and provides a deceleration force which stops the forward momentum and allows the load to skid to a halt in a matter of feet from the point of impact.

The future possibilities of this system are almost limitless. Some newer ideas include the delivery of vehicles without platforms; that is, extracting vehicles on their wheels or on breakaway skid boards. This would enable them to be driven off the drop zone immediately with no derigging required. Newer still are visions of "People Pods." Using basically the same system, a people pod will place troops on the objective in small units, probably squads.

As the Army grows and improves, so does its requirements for mobility, and accurate and timely resupply. Perhaps LOLEX is our answer.

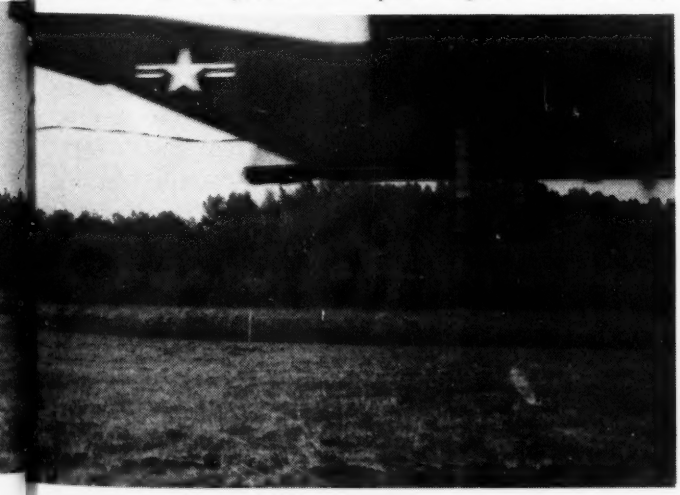


LOLEX method permits a variety of deliverable loads. Here are forty-two, 5-gallon cans on skid for delivery.

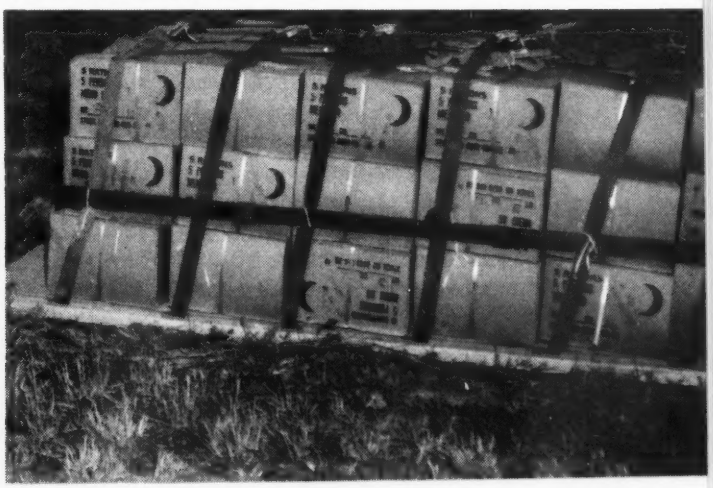


Rigged on 4 x 8 skidboards ready for LOLEX delivery are 126 cartons of 5 in 1 rations.

kids churns up the ground on impact. Right: same bundle.



Note almost negligible damage has been done



Smoke Gets In Your Eyes

Donald S. Buck

THE AVERAGE cigarette burns about 5 minutes. During such a 5-minute period, a cigarette can contribute significantly to a potential accident.

First, cigarettes interfere with vision — not much, but some. One effect of nicotine in the body is that it constricts the small blood vessels, including those which supply the eyes. The result is a measurable loss of acuity. In other words, you can't see quite as well after a smoke. With flying as tough as it is today, this fact should give you pause. This doesn't mean smokers can't see well enough to fly safely. It means that they don't see as well as they would otherwise.

Second, cigarettes cloud up your windshield and windows. Tobacco smoke contains an assortment of tars and resins which have become the center of research and argument concerning their possible roles as causes of cancer. While I cannot confirm nor deny this accusation, I do know that these tars collect on window surfaces to obscure vision.

If tobacco doesn't get you by causing cancer, it may do the job by causing an accident! But, unlike cancer, this hazard can be readily wiped away. Periodically cleaning windows with a paper towel will clear up your vision to a significant degree. Proper cockpit ventilation will clear the smoky air and keep your aircraft from looking like the smoker on the *Super Chief*.

Another effect of smoking is the quantity of carbon monoxide and carbon dioxide gases which are thrown off. These gases are insidious in that they can be accrued in the body over a prolonged exposure. They make one somewhat drowsy and inattentive, and they fuzz up vision.

Tobacco smoke contains the same gases as the exhaust of your aircraft, and you've learned to respect the toxic effect of that hazard. *Continuous* smoking in a tightly closed and nonventilated aircraft is very much like a hole in the exhaust system, continually leaking a tiny quantity of the gas into the cockpit to contaminate the air you breathe. Breathing your smoke once *is bad* enough. Don't try to live in it! Ventilate!

Another danger of smoking is its distractive side effects. When the hot ash drops off into your lap, it is apt to take your attention from flying. A burning cigarette dropped in the aircraft makes things interesting — particularly if you sit on it or if it can't be found.

One of the most important hazards related to smoking is fire. Most smokers forget that "where there's smoke, there's fire."

Smoking may have its good points. But it interfers with your vision, it clouds your windows, it gives off toxic gases, and it's a constant fire hazard.

This material was adapted from a ground safety lecture. Mr. Buck is Director of Safety, USCONARC.

While on an aerial recon mission you're fired on. You need artillery, fast. Know what frequency to use? The unit call sign? Include artillery support in your combat mission plans. You can always

Take it with you

Captain Carl L. Ross and Captain Glynn E. Eberhardt

ARTILLERY IS the most lethal weapon available to the aviator. Most aviators, through their aviation training and general military background, have been provided with the methods and procedures for adjusting artillery fire. However, if the aviator is called upon to take a target under fire, will he be able to effectively put these methods and procedures to work? Probably yes, but not without unnecessary difficulty.

The reasons for these anticipated difficulties can be attributed directly to the aviator's failure to properly plan his mission. Regardless of the purpose of the mission being flown, planning should always include the possibility of adjusting artillery fire on targets of opportunity. As one aviator said in relating his experience during the Korean War, "I was never called upon to fly an artillery adjustment mission; however, I hardly ever flew a mission that I didn't adjust artillery fire."

Regardless of his mission, every aviator who does not consider the possibility of engaging a target of opportunity with artillery fire and who fails to plan accordingly is guilty of limiting the capabilities of both aviation and artillery. The additional planning necessary consists merely of gathering a few bits of information and material.

Place yourself for a moment as pilot of an observation helicopter flying a reconnaissance mission in a combat situation. En route to your area of reconnaissance you begin receiving intense automatic weapons fire from a ground position. It becomes evident that this fire will prevent the completion of your mission, so you back off out of range to consider your possible courses of action. Artillery is the answer! Within a maximum of 15 minutes you can silence these weapons and continue your mission — provided you are prepared. Ask yourself, "What do I need to know in order to call on the Artillery?"

First, you must know who can supply the fire necessary to neutralize your target. This information can be obtained simply by referring to paragraph 3 of the supported unit's operation order. As a minimum, it will list the artillery organization for combat. Thus you can quickly determine the artillery support available.

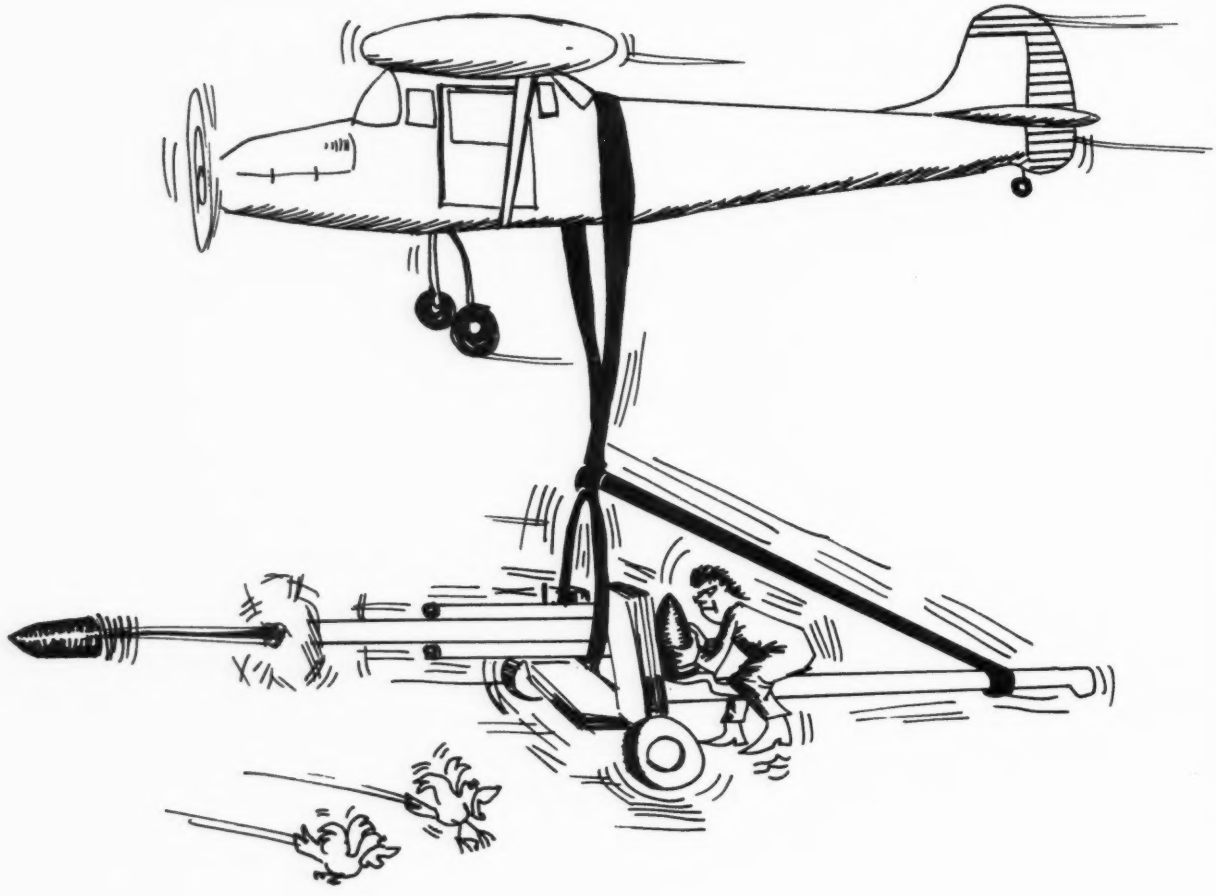
Capt Eberhardt is assigned to the Special Subjects Division, Dept of Tactics, USAAVNS. Capt Ross is attending the Artillery Officers Course, Ft Sill, Okla.

Now that you know what units to call on, you must know how to call. What frequency do you use and what is the unit's call sign? This information is available in the SOI (Signal Operations Instruction) of the supported unit, but it is of little value unless it has been extracted and carried along on the mission. Record these frequencies and call signs and have them where they will be readily available at all times. In personal interviews with aviators flying in support of division level exercises, the concensus of opinion was that 95 percent of all missions were flown with no consideration given to an artillery SOI extract. Little harm is done in wargames by this, but don't let a habit develop that later could diminish your effectiveness in combat.

Another piece of information, which is of the nice-to-know variety, is the exact location of the supporting units. This is available in the fire support plan of the operations order. Knowledge of the location will enable the pilot to use the gun-target line in making sensings and corrections, thereby simplifying his mission. There are, of course, other means of determining the gun-target line; however, prior knowledge of the gun position will usually expedite firing. This information should never be allowed to fall into the hands of the enemy. Remember, artillery is your best friend!

It is always desirable to be aware of the known points and concentrations within your sector. These also are available in the fire support plan of the operations order, and in many instances will aid the observer in locating the target accurately and rapidly. If time permits, record these known points and concentrations on a tactical map and carry it along with you.

As a minimum in planning any combat mission, always know who can supply you with supporting fire and have available the frequencies and call signs of these units. This information coupled with a basic knowledge of adjusting procedures will allow you to use a tried and proved method of inflicting casualties on the enemy. Be aware of its capabilities and be prepared to call on *the artillery!*



William H. Smith

Ordinary gasoline can be used BUT

The Beaver will operate on 80/87 octane avgas, but suppose your unit's supply is depleted and an emergency flight is necessary. There's plenty of truck gas. Can it be used safely?

I LOOKED DOWN at the still face of the young soldier. He was pale and a bump on his head was clearly visible. One eye was swollen out of proportion, although it had not been hit when he fell.

The accident happened early one frigid morning. On his way to the mess tent, the soldier slipped on ice and struck his head against the sharp edge of a ¾-ton truck. He was knocked out.

As commanding officer, I had been notified, of course, and by the time I arrived at the scene the soldier was coming around. When I talked to him he even smiled a bit at his own carelessness. But something was obviously wrong; as I watched he became pale and slipped into a coma. Then I noticed that his left eye had begun to swell and become discolored.

Our unit was too small to have a doctor attached, so we depended on the one at topside. Fully alarmed, I radioed the doctor. He listened to my unprofessional explanation and replied, "I'm not sure, of course, but from what you say, it sounds like he has a hemorrhage of the brain. Captain, you had better get that man here right away."

Now this wasn't so easy to do. It had been a hard winter in northern New England, and the one road leading from our unit was thick with ice and impassable most of the time. In the last few days it had been snowing intermittently and surface transportation was out.

But we weren't cut off entirely. The one and only aircraft in the area came in almost daily, using the little landing strip that we kept cleared of snow.

Two days ago Lieutenant Scheifer, the pilot, had come in to bring some food and had stayed, waiting for the weather to ease up a bit. The plane was here now and available for the emergency trip. I felt sure the lieutenant would be willing to take off and fly back, in spite of the weather.

I explained the situation to him and as I had expected he was ready to fly. He dashed out of the tent and headed for the strip. My first sergeant rounded up some men and went to clear away the new fallen snow.

This was all I could do for a while, so I strolled over to the mess tent for my delayed breakfast. There I found the S-4. As we ate we talked about the accident.

Suddenly he stopped eating. The piece of toast he was about to bite into returned to his plate.

"Good gosh!" he said. "I just remembered. That last shipment of avgas didn't get through. We don't have enough to send the Beaver back."

I wasn't rated so at first I didn't understand the significance of this. To me gasoline was gasoline, and we had plenty of fuel for our trucks. But the S-4 quickly made me understand that avgas and truck gas are not the same, even when the octane rating is identical.

Realizing what I had asked of the pilot, I went out to the strip. There I found him busily supervising the unloading of jerry cans, all from our little dump and intended for truck use.

"Scheifer," I said. "I just found out about the gasoline. I don't know what the difference is but the S-4 says it's dangerous. I can't ask you to make the trip."

"Thank you, Captain," he said, "but I'd like to go anyway. That kid needs help."

I didn't really think he'd say otherwise. However, my concern must have showed.

"Don't look so worried," he said. "I figured an emergency like this might happen some day. I know just what to do."

I thought about it for a moment. If Lieutenant Scheifer was willing to take a chance for a soldier he didn't even know, I should be willing to do the same for one of my own men.

"All right. You can fly if you're determined, but I'm going along."

"It's not necessary for you to go with me, Sir. There's no sense in both of us risking our necks."

"I can help with the patient while you fly. And besides, it's my neck."

Scheifer looked at me for a moment, shrugged his shoulders, and went on with his work.

Since I was going along on this jaunt I decided to watch the preparations and see if I could help. The first thing I noticed was that all the jerry cans were new ones. Lieutenant Scheifer had selected them for some reason. He had sent a young corporal off to get something else and was apparently waiting for him to return. I decided to ask about the cans.

"It's because of rust or flaking paint. New cans are less likely to have this kind of trash than old ones.

"A little rust or other foreign matter can be deadly. If a truck filter gets clogged up you can always get out and do a fair job of cleaning it. Not so with an airplane."

About that time the corporal returned. He was carrying a piece of wire and a chamois cloth.

"Got the wire you wanted," he said, "and I also brought you a chamois. Thought you might like to strain the gas."

"Thanks, but I'd rather do without the chamois. Too risky. That chamois will take the water and foreign matter out, all right, but it causes a build-up of static electricity. Burn up this airplane and that man won't get his doctoring. No, I'd rather do without."

"How about a piece of clean cloth. Won't that do?"

"The cloth will take out some of the big stuff and replace it with lint and a lot of other junk to clog up the fine jet holes in the carburetor."

The lieutenant took the wire and attached one end of it to the airplane. He scraped the paint off a small part of the handle of a jerry can and attached the other end of the wire to it. Satisfied that the can was grounded to the airplane, he proceeded to pour the gas in the tank. I noticed he left a pint or two of gasoline in each can. This I learned later was an additional precaution to keep any sediment from entering the tank.

After he had filled the tanks, he drained them. There was no sign of water.

His preflight finished, he turned to the sergeant and said, "Go get the patient. Wrap him up good because it's going to be cold. While you're gone I'll go out on the field and run up the engine a bit. I want to see how it will run with this gas."

The engine started all right, but when Scheifer revved it up even I could tell it wasn't running as it should. As soon as the sergeant brought the patient, the lieutenant moved the airplane back to where we were standing. I did not talk to him because he was busy getting the soldier on board.

With everything ready he turned to me and said, "Let's go."

He moved the plane out to the far end of the strip. Even though he had already run up the engine he went through the procedure again. I realized that he was not too sure about the engine and was giving it a chance to quit while we were still on the ground.

After what seemed to me to be at least 10 minutes of runup, Lieutenant Scheifer let the engine idle, switched tanks and revved it up for one more short moment. There was an immediate

improvement in the sound; the engine was definitely running smoother.

We headed down the field and the little plane left the ground without a bit of trouble. As soon as we were in the air, Lieutenant Scheifer again switched tanks. Again the engine ran a bit rough and there was a faint sound of a knock. But it ran and soon I settled down to a nice ride.

I had taken this same flight many times with Lieutenant Scheifer. He usually flew at a comfortable altitude, but this time he stayed close to the treetops. I also noticed that he was flying at reduced throttle.

When we were well on our way I started asking questions, and Lieutenant Scheifer was in the mood to answer them.

He told me that even though the gasoline we were using is the same or higher octane rating as normally used in a Beaver (the Army uses gasoline, automotive, combat 91A in its trucks, which has an octane rating of 91; Beavers will perform on 80/87 octane avgas), you can't be sure it won't knock. Knock rating is controlled by tests. In automobile gasoline the test is made under conditions expected in average driving at sea level altitude. A decrease in atmospheric pressure will cause this fuel to boil at a lower temperature, vaporize more readily, and even form a vapor lock.

He said that in aircraft fuel the test is made under conditions of high power output in a decreased atmosphere of 7 pounds per square inch.

"Back there when you were filling the tanks I noticed you only filled the rear and center."

"I had about 20 gallons of aviation gasoline in my front tank and I wanted to use it to get airborne.

"Without enough fuel to get off the ground, I would have been forced to use the automobile gas. With auto gas you have to take off without using full throttle. This takes a much longer field."

"I see. But why are you flying so low and slow now?"

"Well, at this speed and altitude the engine is not apt to suffer so much. You'll notice that we already have a little indication of detonation. The engine is rougher and is running a little hotter than usual. If I speed it up or fly higher it will get worse and there is a good chance of engine failure."

All this time our patient was riding comfortably enough. He was breathing heavily and every once in a while I'd tuck the covers around him, but this was all I could do for him.

When we came in to land, the lieutenant didn't want to chance the truck gas. He switched back to the front tank containing avgas.

The landing was uneventful. As we taxied in, I noticed an ambulance waiting to take the wounded soldier to the hospital.

After our patient was gone I persuaded Lieutenant Scheifer to go with me when I reported to the CO. Before he left the field he told the mechanic to drain the remainder of the automobile gasoline and test the engine thoroughly.

"If it shows signs of a lean mixture, we'll have to check the carburetor jets."

I'm happy to report that our patient got over his injury and is still in the Army. I became so interested in aviation that I'm now applying for flight school.

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Fuel Truck Monitor Filters

A recent TWX spells out a problem with 2,400-gallon 6 x 4 five-ton aircraft fuel servicing truck monitor filters. The problem is caused by the disc-shaped filter paper within the monitor cartridge being transferred into the fuel stream through the dispensing hose and collecting on the nozzle strainer screen during pumping operations. Investigation by the Warner-Lewis Company, the manufacturer of the monitor filters, revealed that some of the small paper discs in the monitor filter cartridge which came with the vehicle did not meet specification requirements. The TWX states that immediate inspections should be made on each fuel servicing vehicle received under Army contract DA-20-113-MD-29874, to assure that monitor filters are functioning properly. If faulty filters are found, the Warner-Lewis Company is to be notified immediately and requested to replace the faulty filters. Stock numbers of new filters are: Filter Cartridge Model CMS50 MC No. 5 and Liquid Separator Filter CCWS1. Mr. C. B. Stolen is the Warner-Lewis Company representative to be contacted, Tel. Webster 9-5451, Tulsa, Okla. Stations which have difficulty with the filter system on these vehicles should submit unsatisfactory reports (DD Form 1362, reference AR 58-1).

Have you ever declared an emergency and a controller wouldn't clear you to land?

IT COULD HAPPEN TO YOU

Major William L. Hindman

THIS FLIGHT began much the same as numerous others in the year since we had arrived in Europe. We were to take a crew from Germany to Nice, France, to pick up a UH-19 that had lost its engine on a return trip from Lebanon. The 600-mile trip down was without incident.

Having spent two days waiting for the completion of the work, we were ready to return to our home field. We loaded the toolboxes aboard the U-1A and with our crewchief and the technical inspector headed home. The weather was not exactly good or bad. It was forecast to be VFR all the way with some light rain en route. The low freezing level precluded an IFR flight.

By the time we reached Dijon the ceiling had dropped to 1,000 feet and visibility was about 1 mile. We decided that we had gone far enough and, because of the deteriorating weather, that we should get a current weather briefing. Upon landing at the French military base, we were greeted by armed guards and ushered to the base operations. It was readily apparent that we were not welcome and the language barrier made it difficult to explain our plight to the French officer. His only comment was that the weather was good and we had to go. With no alternative, we departed.

We continued to the German border where it became obvious that we would never be able to make it over the mountains. As this was winter, we were extremely concerned with the freezing level and decided to call the area controller to see if an IFR flight could be made. The controller came right back with a clearance of 5,000 feet to Stuttgart. We asked for the freezing level and icing conditions, but he instructed us to call FERENA Control (French Air Force).

By this time, the rain had reduced visibility to less than ½ mile, so we started our climb to altitude and at the same time called FERENA Control. Contact was established at 3,000 feet. Again we requested the freezing level and icing conditions. The controller's only comment was that we were cleared to Stuttgart to maintain 5,000 feet. By this time we had reached 4,000 feet, and the rain was forming clear ice on the aircraft. We made another call to FERENA Control and informed the controller that we could not make it to 5,000 feet. He instructed us to contact Munchen Control.

The aircraft made it up to 4,200 feet but refused to climb any higher. We informed FERENA Control that we were returning to Basel Mullehouse, to which he replied, "Negative; contact Munchen Control." He was then informed that we were declaring an emergency as the aircraft had accumulated about an inch of clear ice. We began descending. The last reply we heard was, "Negative emergency; contact Munchen Control."

A call was made to Basel approach and our situation explained. We slowed the aircraft as much as possible and locked the shoulder harness (and prayed). Fortunately, the descending path of the aircraft brought us down the forward slope of a mountain and into a valley which led to the Basel airfield.

It was three days before the weather improved enough that we could continue our flight. The only place we could file into was Frankfurt. After arriving at Frankfurt, we were informed that it would not be possible to get to our home base, which was only one hour's distance, due to the lack of an alternate.

While we were talking to the forecaster, a young pilot came in to file a flight plan to Stuttgart, which was just carrying approach minimums and forecast to go down. The forecaster informed him that the closest alternate available was Nice, France. The pilot was flying a U-6, and he stated he had 6½ hours of fuel aboard and Nice was all right for an alternate. He got his weather and departed.

As we left the operations building for our BOQ, a mental note was made. If he could arrive at the Stuttgart facility, and if he did not pick up too much ice on his letdown, and if he did not try for a second approach, he should be about 45 minutes out of Nice when he ran out of fuel.

A good active safety program is essential to the continued well being of a unit.

SAFETY IS A STATE OF MIND

Major Neal H. Roach

WHEN THAT young lieutenant pins on his shiny new wings for the first time, he is a very sharp and mechanically proficient aviator. It is too bad that we can't take a needle full of experience and judgment and inject him with it just before he departs for his first unit. Perhaps this would save our accident investigation boards a lot of time and effort.

A Senior Army Aviator, Maj Roach is assigned to joint staff duty with the Federal Aviation Agency, Atlantic City, N. J.

Now, since we cannot take this desirable course of action, we, particularly the old timers, can and must do other things to ensure that this young pilot will be around long enough to obtain his experience and judgment.

Not long ago, an aviation unit commander almost apologized for requesting that I attend a monthly safety meeting. He thought that, because of my years in the Army Aviation business, I would object. I had to assure him that I would be most happy to attend, even though it meant driving 130 miles. If I ever get to the point where

I think that I know everything there is to know about "driving airplanes," then it will be time to turn in my badge.

I have been around Army Aviation long enough to know that a good, active safety program is essential to the continued well being of a unit. Notice, I said *active*. I am not referring to the lip service type of safety program that we have all been exposed to — the kind that is brought out once or twice a year and dusted off for an inspecting officer's benefit. I mean the kind of safety consciousness that permeates an organization. You feel it in the manner in which every man performs routine duties such as properly grounding aircraft during refueling. You sense it when you look around operations and maintenance activities and notice an up-to-date crash grid chart or an efficient program for training unqualified maintenance personnel. You also become aware of it when you talk safety with pilots and crewchiefs and find their response sincere and interested.

Safety is much more than appointing a safety officer, attending compulsory safety meetings, and subscribing to safety publications.

Safety meetings, of course, can be one of the strongest factors in any safety program. The trouble is that so often they fall into the category of compulsory periods of boredom. One of the most satisfying techniques for conducting a meeting is the use of small groups of aviators in a well organized session planned for maximum audience participation (much like a bull session). With a significant, provocative, and timely subject for discussion, safety meetings can be both interesting and instructive. I firmly believe, however, that more safety information is exchanged in bull sessions and hangar flying than you could ever receive from attending the usual poor safety lectures or reading safety publications. Not that these aren't necessary; they are. We can, if we will, learn from the mistakes of others.

Little tips and bits of information exchanged over a cup of coffee, have paid off in safety. For instance, "If you only *think* you can do something in an airplane, don't try it. You may exceed the capability of either the aircraft or yourself, with disastrous results."

"In combat, it's mission first; in peacetime it's safety first."

"When you have an emergency, keep flying, mentally, because if you ever stop, you're dead."

Such ideas and mottoes, if repeated often enough, will become a part of a man's mental outlook on his job, whether he is a "throttle jockey" or a "grease monkey."

It's up to the older pilots and mechanics who have made mistakes, profited by them and otherwise gained experience while developing good judgment, to help the "young uns."

I must say a word to and, I'm afraid, *about* some of our senior pilots. It is human nature to resent being told that we are wrong, but it is also a fact that all of us do make mistakes. I think we have all been guilty, at one time or another, of refusing advice from our younger pilots and mechanics. We all can learn from one another. If a younger pilot hesitates to tell us when we are wrong or when we make a mistake, then he is not doing us any favors. And if we feel too proud to accept courteous, well-meant advice, then we had better go out and renew our supply of "humble pills."

Safety consciousness is a never-ending, all-encompassing job. It is the result of active organization and participation on every level.

Have you given some serious thought to your safety program lately? Think it's about time? You could, perhaps, prevent one of your people from becoming a statistic in an accident report.

A sure sign of good flying is the smooth manner in which a flier performs certain maneuvers — rollouts, climbouts, getting a new heading, etc. The key word to smooth flying is anticipation. A smooth flier anticipates the need for certain maneuvers and changes of attitudes.

The U. S. ARMY AVIATION DIGEST 1963 Index is available by request. Address: Editor, U. S. ARMY AVIATION DIGEST, U. S. Army Aviation School, Fort Rucker, Ala.

Rivets

Reprinted from SERVICE NEWS, Nov-Dec 1963, Lockheed-Georgia Company, Marietta, Ga.

Huck. Cleco. Hi-Shear. Hi-Lok, Jo-Bolt. Ice Box. These are words as meaningful to the airframe mechanic as are VOR, UHF, and LOC to the electronics man . . . zero-zero to the weatherman . . . A-OK to the missileer . . . or 201 to the people in personnel.

As fasteners — rivets, especially — become more specialized there is an increasing tendency to refer to them with names that may or may not be meaningful. In this article, we propose to identify (and give a few facts about) some of the most used rivets with their names and with their (often far more meaningful) part numbers.

First, What is a rivet? A fastener is a rivet when some part of it is permanently deformed or altered during installation. Thus the rivet,

upon installation, becomes a *permanent* fastener. Part or all of a rivet is destroyed upon removal.

The varieties of rivet types are numerous and still increasing. Depending upon their application, rivets are designed with special consideration given to corrosion resistance, ability to endure extreme temperatures, chemical and physical compatibility with aircraft structure, etc. Numerous head and sleeve designs are available to fit in with the functions of various parts. And, as is true of everything going into an aircraft, a prime design consideration for every application is minimum weight.

SOLID RIVETS

The simplest aircraft rivet is still the solid type that is secured in place by upsetting or mushrooming the end of the shank. Solid rivets are used whenever more complex types are not specifically required. The shank is upset by hammering (driving or shooting) and bucking or by squeezing to form an upset head to prescribed dimensions. A rivet set of the correct type and size must be used. A set too small damages the rivet and one too large damages the material around the head. Bucking bars of suitable weight and shape for the size and location of the rivet are important to the quality of the driven rivet. Rivets of some alloys work-harden quickly, requiring fewer but harder blows in upsetting and this, in turn, requires a heavier bucking bar.

All tools must have smooth, clean working surfaces, and must be held square with the rivet so the center of force is applied near the centerline of the rivet. It takes practice to develop feel and timing as well as the correct pressure for a particular rivet. When testing power driving tools, hold the set against a piece of wood or practice work to avoid injury from a flying rivet-set. Never test directly against solid metal.

CLECO FASTENERS

Temporary, easily-removed fasteners are often used to align and hold the parts to be riveted. These are commonly called Cleco fasteners, although they are actually tools and are never used as permanent fasteners. Special pliers are used to insert and remove these from holes provided for rivets and other type fasteners.

REMOVAL OF SOLID RIVETS

The process for removing a solid rivet from its installation is fairly simple, but it requires some degree of care and skill. Except for AD alloy rivets (which have a centered dimple) the head must be center-punched lightly for drilling. The right size drill bit is one slightly smaller than the rivet shank. Drill through the head and slightly into the shank. Snap the head off, then drive the shank out with a pin punch. Use a light hammer, and preferably use a backup for the material around the rivet shank.

RIVET ALLOY CHART

MATERIAL CODE	HEAD MARKING	MATERIAL	APPLICATION TEMP LIMIT
A	Plain	1100 99% pure alum.	500°F
AD	Dimple	2117 alum. alloy	200°F
B	Raised	5056 alum. alloy	350°F
D	Raised	2017 alum. alloy	200°F
DD	Raised	2024 alum. alloy	200°F
M	Plain	Monel	900°F

NORMAL USE

M	With steel or titanium or near corrosive areas
AD or DD	With aluminum
D	Sometimes used instead of DD in the field
B	With magnesium

ICE BOX TYPE ALLOYS

Many pages could be used in describing alloys, heat treatments, and aging processes for the various rivets. Included here are some charts that will give you brief descriptions.

An alloy deserving particular note, however, is one that ages (or hardens) so rapidly after heat treatment that rivets of this material must be kept frozen until they are used. This alloy is 2024 aluminum; the rivets are coded DD and are identified by two raised dashes on their heads. They are often referred to as *ice box rivets*, although they must be stored at -10°F or lower.

Take only as many of these rivets as you can use in 15 minutes. A small insulated container and dry ice are useful in keeping them cold while you work. Each rivet should feel cold when you place it in the work. Once removed from the freezer, DD rivets should not be returned to storage. Refrigeration does not reverse the aging process; it only retards it. (Unused rivets can be salvaged, however, and reheat treated to the T31 temper condition.)

SPECIALIZED RIVETS

The material of the shanks of solid rivets has to be soft enough to be shaped into an effective head when it is installed. The softness of this material is a limiting factor in the strength of the rivet. The same is true of rivets that are upset in place by a pull pin, and also of the semi-tubular types. All of these are useful in suitable applications.

As the airframe industry has advanced, requirements for more durable but lighter rivets have been met with two to four piece rivets, using the most suitable alloy in each part. Some of the complexity of these designs results from making them useful in blind applications. The BL-blind Lockbolt and Jo-bolt are among the more important. Special tools are essential for these types.

In many applications shear is the most severe load a rivet must withstand. This indicates that the shank material must be strongest. The rivet must also fit tightly in its hole for maximum resistance to shear or to elongation of the hole. The shank of a solid rivet expands during upset but such malleability does not exist in the pins or shanks of the more complex designs. Therefore, "snug," or interference fits, are specified on many of them.

An example of a two-piece rivet is the Hi-Shear which, as its name implies, resists high shear loads. Its installation is somewhat like that for one-piece rivets. The shank material is easily shaped by a special upsetting tool to form a securely driven head.

Huck shear-type Lockbolts have characteristics similar to Hi-Shear, but their installation requires another set of tools designed specifically for Lockbolts. The stump type is installed in much the same way as Hi-Shear but the pull-type Lockbolt is upset by simultaneously pulling on the pin and pushing on the collar. The collar is pressed into serrations in the remaining part of the pin. The pulled end of the pin breaks at a groove designed to allow a predetermined amount of tension necessary to secure that particular rivet.

Rotary tools are used to secure two of the rivets shown. Torque is applied to a special nut on Hi-Lok and to the end of a special screw in the Jo-Bolt. Screw threads draw the work up that last thousandth of an inch and then secure the rivet in place. In each case a shear section in the turning part of the rivet determines the maximum torque by breaking when the completed installation gives a sharp rise in resistance to torque. The hex section of the Hi-Lok nut breaks off and the end of the screw in the Jo-Bolt breaks off.

HI-LOK FASTENERS

There is little practical difference between a Hi-Lok fastener and a bolt and nut. While there are no provisions for holding the head of the pin, a hex recess is provided in the threaded end of the shank. The tight, interference fit of the pin in its hole helps to keep it from turning as the nut is tightened. The shape of the nut provides an effective binding surface against the work and an out-of-round self-locking ring grips the threaded pin. A breakneck groove is between this section and the hex part where the torque is applied.

Hi-Lok rivet pins are to be squeezed completely into position before torque is applied to the sleeve (or nut). The pins are not to be drawn into the hole. If hammering the pin is unavoidable, the structure must be supported; the hammer must not weigh over 12 ounces, and it must be plastic tipped.

The HL90 collar is counterbored to clear the imperfect threads that come through when the pin is correctly installed. If you can't get the right length pin for a job, you can use one a size longer by placing one AN960 OD plain aluminum washer under a protruding head or the collar, to space it correctly.

In some applications Lockheed uses MS21042 steel nuts on HL50 or HL51 Hi-Lok rivet pins as an alternate to the HL90 - ( ) A collar. A washer must be used under the MS21042 nut to correspond to the counterbore in the HL sleeve. This prevents the nut or sleeve from bottoming out on the exposed imperfect threads of the pin shank. The washer also helps you avoid marking the material being fastened with this standard nut.

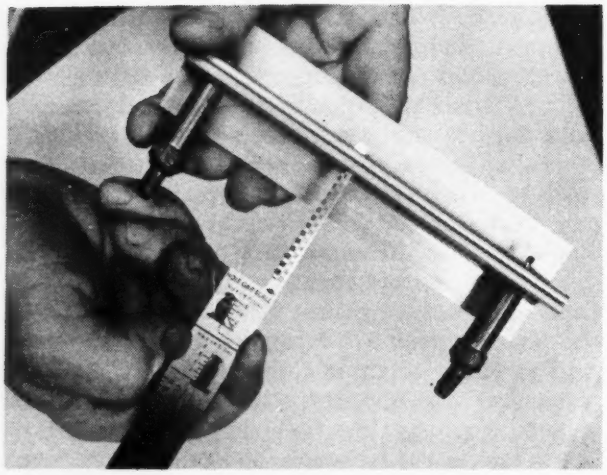
NOMINAL PIN SIZE	NUT USED	TORQUE IN INCH-POUNDS
5/32	MS21042-08	20 - 25
3/16	MS21042-3	30 - 35
1/4	MS21042-4	70 - 80
5/16	MS21042-5	170 - 180
3/8	MS21042-6	220 - 240

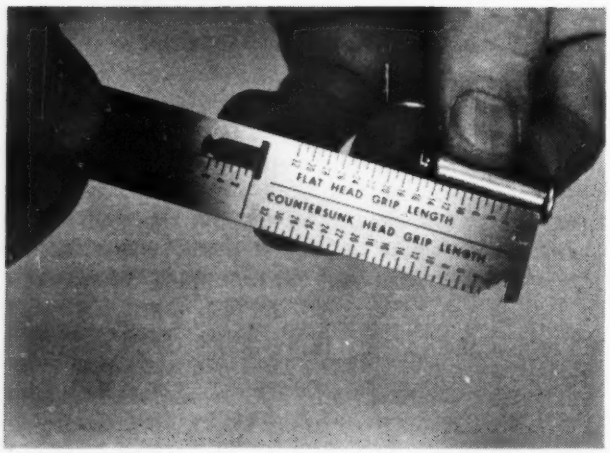
Torque requirements with MS21042 steel nuts are as follows:

To remove a Hi-Lok fastener use pliers, preferably vice grip type. Needless to say the used nut is scrapped, but normally the pin is undamaged and can be used again.

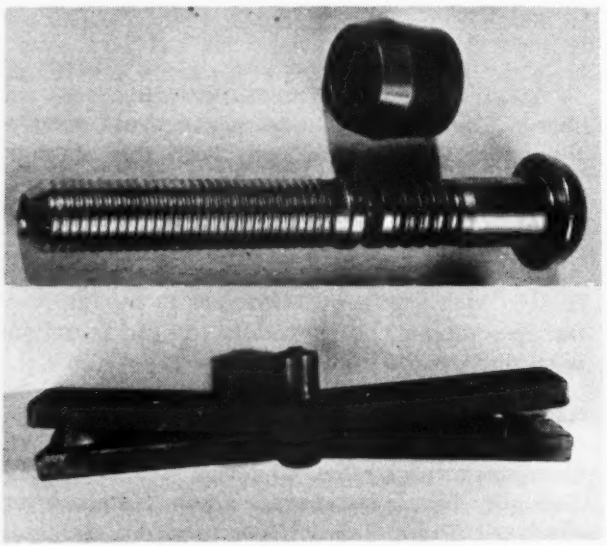
JO-BOLTS

Jo-Bolt is National Screw and Manufacturing Company's name for a design series of high strength, blind fasteners. These fasteners are used in C-130s [also CV-2s and OV-1s] only where loads are primarily shear and where only one side of the parts being fastened is accessible.





Two applications of the Hi-Shear Grip Scale are shown. In a blind application, the scale is hooked against the inside surface of the parts being fastened and the grip length, in sixteenths, is read from the outside.



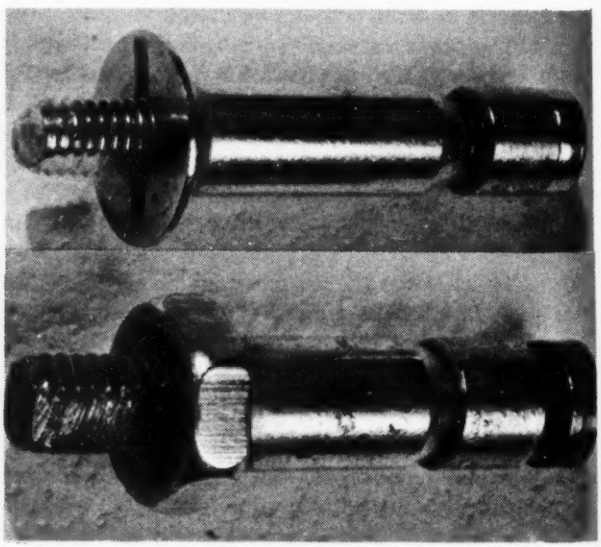
Huck Lockbolt pin and collar. The bottom view demonstrates the pull-down capability of this special fastener.

They are installed in much the same way as other blind rivets, requiring special adapters for hand or power tools used to drive them.

Probably the most important application of Jo-Bolts is in repairs where high shear strength is required at inaccessible locations. Jo-Bolts are available in sizes suitable for replacing fasteners where the hole may be slightly enlarged from previous installations or where it is necessary to redrill the hole to size. Jo-Bolts nominal sizes are full or slightly oversize, compared to standard nominal sizes.

The Jo-Bolt is held securely in place by a steel sleeve which is pulled up and expands over the shank of the nut. A special steel screw with a left hand thread has been screwed into the Jo-Bolt nut. The nuts for Jo-Bolts resemble bolts in their outline but actually are nuts in operation. The expandable sleeve was placed on the screw before the nut. The outside diameter of the sleeve is the same as that of the nut before the sleeve is expanded during installation.

When the left handed driving screw is turned to the right (cw), it pulls the sleeve up on the shank of the nut and against the inner face of the part being fastened. Of course, the nut must be held stationary as the screw turns and it will remain stationary after the Jo-Bolt is fastened securely. The screw has a built-in torque limiter in that a shear point is located just below the slabbed section. When the Jo-Bolt is correctly installed, the expanded sleeve will have been pulled up against the inner face of the part and the broken end of the remaining screw will be



Jo-bolts

practically flush with the skin surface or the top of the nut (depending on the type of nut).

Jo-Bolt part numbers are listed in [Chapter 3] Section 1 of your Structural Repair Instructions (the -34). Recently some slight changes have been made in these numbers, but the dimensions and materials for the rivets are basically the same. The new part numbers represent the same rivets, except that they are manufactured under more rigid quality control. At present both the new and old part numbers are given.

The letters, which make up the first part of a Jo-Bolt part number, stand for the design and material used for the nut. An example is the FF (formerly F) which stands for a flush top steel nut. The nose adapter engages the nut top by means of the cross points in cross recesses. The letters FA were for the millable flush aluminum nut type. The new number for this type starts with SSHFA. Before being milled flush, this aluminum type has a protruding hex top that engages with the nose adapter during installation. A protruding steel nut is identified by the letters PP. The same shape in aluminum is PA. The tops of these protruding nuts are not millable.

As mentioned previously, the diameter of the grip of the nut is a little oversized on the regular series of Jo-Bolts. They are also available in diameters a little larger than the regular oversized Jo-Bolts. These are for the same nominal sizes and have the same part number except for the letter O just after the first letters identifying the material and just before the nominal diameter. These are useful when a hole is just over the size allowed for the regular types. Oversized fasteners should not be used indiscriminately and you should seek qualified specifications for the particular job at hand. The -34 covers most of these.

The numbers following the letters in the part number represent the nominal diameter of the grip length of the nut. They are for identification only, although the figures are in the range of those in the decimal diameter.

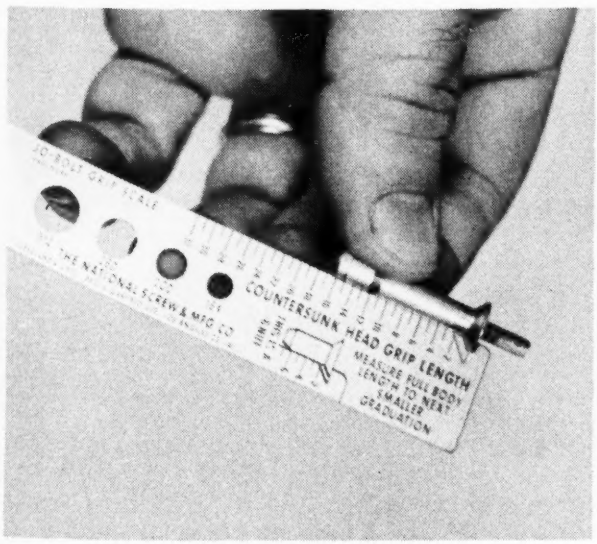
The dash numbers representing the grip length range follows the numbers representing the nominal diameter. These dash numbers bear no resemblance to the actual decimal dimensions they represent, but each could be considered to represent approximately the middle of the grip range in sixteenths of an inch. The range is a sixteenth in every case, so the increase from one Jo-Bolt length to the next is continuous. The dash number meaning is the same in all sizes and series.

The -1 represents the grip range of 0.031 to 0.094 inch which is from 1/32 to 3/32 as fractions go. The highest dash number is -16 which is shown to range from 0.969 to 1.031 inch.

If you find a three digit number, in addition to those mentioned for Jo-Bolt part numbers, it specifies the AN standard drawing used to design the nut top (equivalent to a rivet or bolt head). These would replace such AN fasteners when specified for a particular repair.

As with other similar fasteners the success of the job will depend on obtaining the right tools and using them correctly as well as the selection of the right size and length fastener.

Jo-Bolts can be installed only with tool adapters designed for them. When the hole size and Jo-Bolt size are within allowances and when the correct grip length has been selected, actual driving of this fastener is automatic and quick. It is



Notice particularly the position of the top of this flush head rivet measured on a Jo-Bolt Grip Scale

SAMPLE PART NUMBERS FOR JO-BOLTS

PART NO.	HEAD AND SIZE
FF164-1 (OLD F164-1)	FLUSH-STEEL: 5/32" NOM DIA -NOM GRIP 1/32"
SSHFA260-2 (OLD FA260-2)	MILLABLE HEAD-ALUM: 1/4" NOM DIA -NOM GRIP 3/32"
PP312-16 (OLD P312-16)	PROTRUDING-STEEL: 3/16" NOM DIA -NOM GRIP 1"
PP0164-8 (OLD P0164-8)	PROTRUDING-STEEL (OVERSIZED): 5/32" NOM DIA-NOM GRIP 1/2"

necessary to hold the driving tool squarely in line with the fastener so that the nose adapter will engage properly with the nut to prevent it from turning when power is applied to the wrench adapter. Aligning the driving tool with the fastener also avoids breaking the driving screw prematurely.

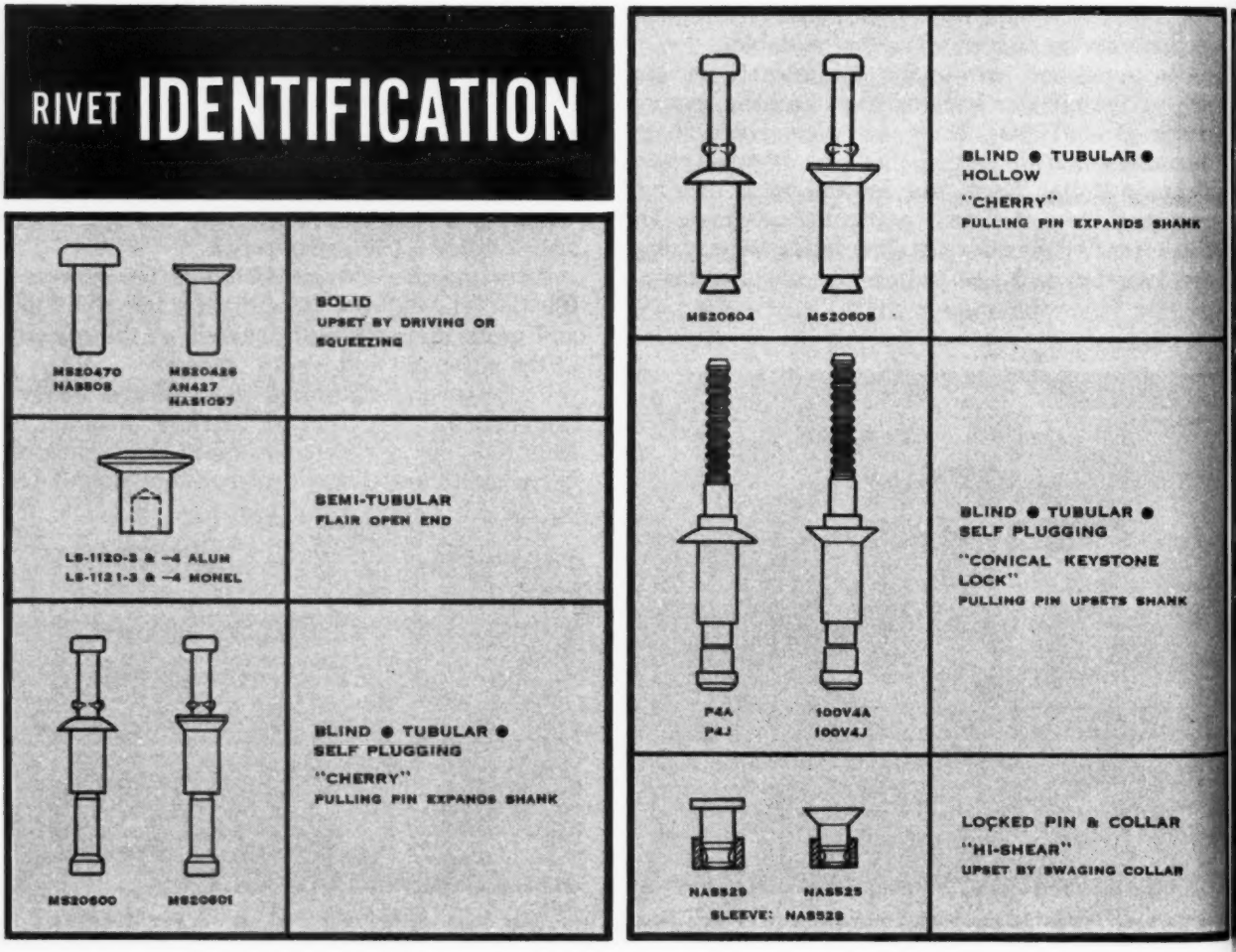
The Structural Repair Instructions have, or will have in a future change, a table of part numbers for nose and wrench adapters for electric, pneumatic, or hand tools to be used in installing Jo-Bolts. Generally, the wrench adapters for a given tool will be the same for all Jo-Bolts of a given size, but the nose adapters for the nuts will be different for each nut type as well as different for each size and type of tool.

The selection of Jo-Bolts of the right diameter will first depend on the specifications of the work to be done, then upon the size and condition of the hole, if this is a replacement. Charts in your -34 give Jo-Bolt part numbers, their nominal diameter, the drill you use and the limits of the final hole size. These charts include the regular sizes and the oversizes mentioned previously.

The next important step is to determine the overall thickness of the material to be fastened so that the correct grip length of the Jo-Bolt can be determined. A length selector gage pictured [page 23] was designed especially for this job. This gage will not always give the final length but it will give you something to base your final decision on.

You hook the small end of the length selector gage on the surface at the far edge of the hole provided for the Jo-Bolt. At a point flush with the outer surface, a scale on the gage gives you the grip length range for the Jo-Bolt you need. To repeat, this is something to go on and if there are no variable spaces between the layers of the material to be fastened, this direct reading will give you the correct grip length.

The grip length of each Jo-Bolt must be within



1/16 inch of the final thickness of the material after it is fastened. Since Jo-Bolts are available in lengths increasing by sixteenths there will be a right one for any thickness. Should you be fastening parts that vary in thickness from one hole to the next you will need a variety of lengths handy.

As with so many other jobs, a little practice will help you get the feel of the tools and can help you avoid some inconveniences and delays on an actual job. Feel helps but you can't rely on it entirely, so there are ways to check installed Jo-Bolts for security.

An obvious indication that the wrong grip length was selected or that the driving tool was held incorrectly is when the drive screw breaks too far down inside or too far outside the nut. Flush with the skin surface is ideal on flush and millable aluminum types. Flush with the nut top surface is ideal for the protruding type.

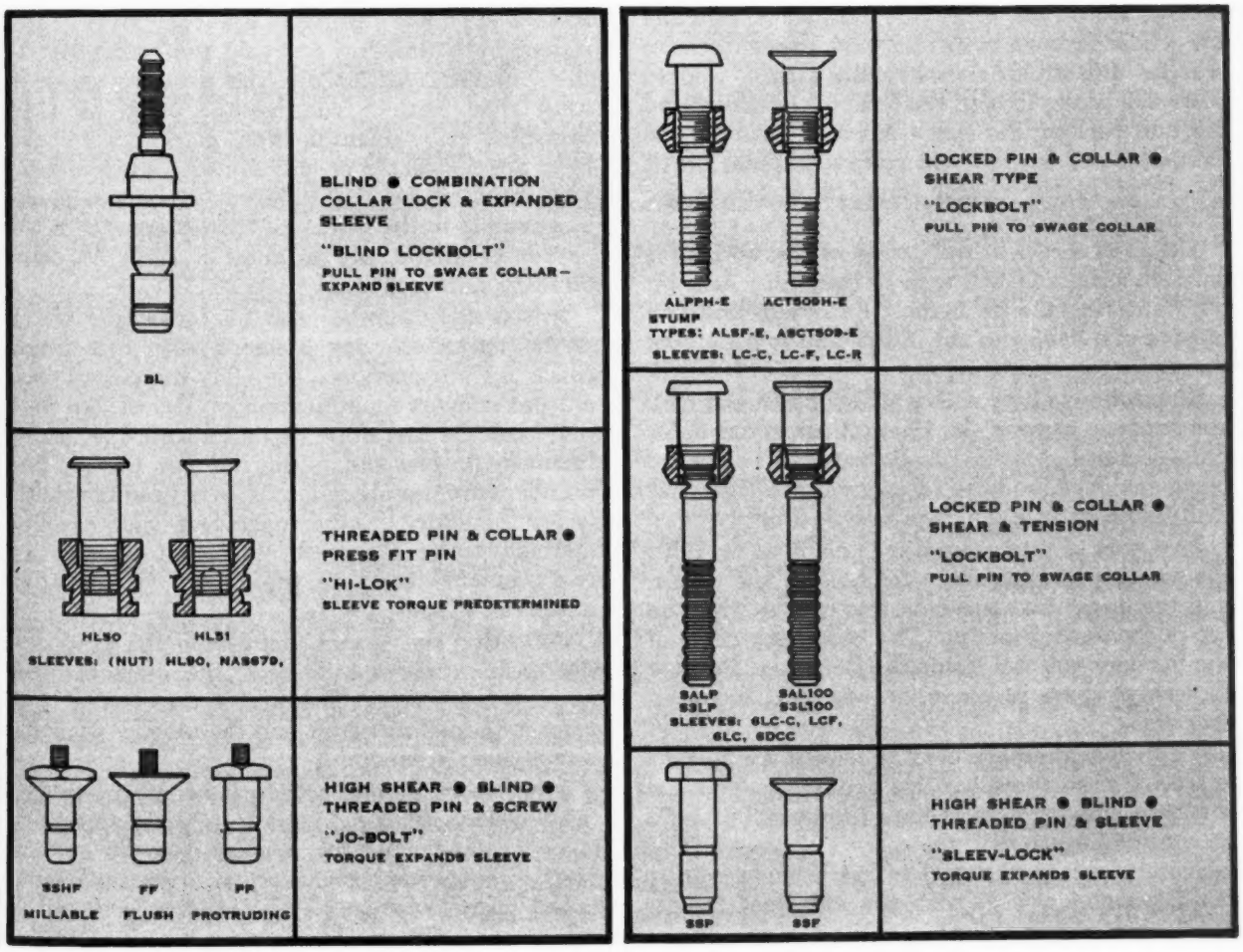
A table of break-off limits appears in your -34. One way to check Jo-Bolts for security is to use a torque wrench. A lot of care is necessary here because you could easily loosen a good fastener in the process of checking it.

The Jo-Bolt is not to be turned in either direction, as loosening will require replacement.

When applying torque to check the Jo-Bolt be sure it is in a counterclockwise direction, and be sure not to apply more than that specified for the test.

The nosepiece used to hold the nut during installation could be adapted to a torque wrench for testing. This approach may be your easiest means for the flush type with the cross recess in the top. Standard sockets will make it relatively easy to adapt the torque wrench to the hex top nuts although some sizes will fit a little loose.

While the Jo-Bolt is designed primarily to resist sheer loads it does, of course, maintain tension to hold the parts together. During installation the screw produces this tension and after installation it remains under tension through the ex-



panded sleeve. The screw threads are gripped in the nut and screw head is binding against the sleeve, which is binding against the inner surfaces of the material it fastens.

Of course the entire sleeve must be below the inner surface (of the material to be fastened) at the start of the sleeve's expansion so it will clamp the material. Otherwise it would only lodge inside the hole and cause the drive screw to break prematurely. The average travel of the sleeve from where it starts to expand until it is securely installed varies with the size of the Jo-Bolt from 0.074 inch for a no. 8 size to about 0.260 inch on a nominal ⅜ size. Preliminary turning of the screw backwards to lower the sleeve will not increase the effective reach of the expanding sleeve because it can't grip until it starts to expand over the beveled end of the nut.

Drilling is the usual way of removing a Jo-Bolt. When you must remove one of these fasteners, check its condition first. If it is securely clamped you can probably drill it out without holding the nut. Do not try turning the nut to remove a Jo-Bolt. Once the tension is released the whole fastener will turn and this will make it more difficult to remove with a drill. Should you have access to both the head of the screw and the nut, backing the screw out and bumping the sleeve free of the nut will release fastener parts. Heads of recent design have cross recess for Phillips screwdriver.

The steel screw in the center of the Jo-Bolt is hard material and will tend to lead your drill bit off. Centering the bit is most important and you may need a device to aid in this and in steadying the drill.

Illustrations along with a table of removal drill sizes appear in your -34. These illustrations show cross-sections of typical Jo-Bolts in the process of being removed, and the table gives the right size drill bit to be used on each size Jo-Bolt.

Two sizes of bit are used on a clamped Jo-Bolt; the smaller bit makes a pilot hole in the screw, and the larger bit centers in this hole to drill the top of the Jo-Bolt nut off. The remaining parts of the fastener will fall inside the structure. Be sure to remove these pieces when you gain access to this area.

A different approach must be used if the Jo-Bolt is free to turn when you try drilling it. You use the nose adapter part of the driving tool to hold the nut while you drill the screw full length. The remaining nut is removed to the outside with a small punch or wire with the end bent into a small hook.

PART NUMBERS

The part numbers for the various configurations of rivets follow patterns similar to those for bolts. Numbers for the ones that have been accepted as standard for military use will begin with MS, AN, or NAS. Others will have the numbers assigned to them by their manufacturers. The numbers and letters following the standard or manufacturer's identification indicate the basic design of the fastener, and apply to all sizes of this design. Code letters may follow these to identify the material or alloy used in the fastener and in some cases its head type. The numbers toward the last indicate size and then length.

The rivet part numbers representing military specifications indicate the diameter and length of their respective rivets with a number corresponding to the dimension in thirty-seconds of an inch. This differs from bolt and screw part numbers which use screw size numbers for diameters up to size no. 8 or in some cases no. 10.

An example of a rivet part number is MS204-26AD4-4. This is a Military Standard rivet represented by a drawing carrying the basic part of this number (MS20426). The drawing shows a solid rivet with a countersunk head of 100°. Standard alloy identification markings for the head are illustrated on this drawing and the basic part numbers for five different alloys are given. The dimple in the head and the letters AD in the part number indicate an alloy of 2117. (A chart on alloy numbers is on page 20.)

In this alloy number, the 2 is for copper which is the major alloying element with aluminum. Since, for our purposes, the alloy number is used only to support identification of a rivet, we note only that the last three digits indicate the manufacturing process and, in this number, the last two numbers are the obsolete numbers used previously for the alloy. In other examples, such as commercially pure aluminum (99% pure), the last two numbers indicate the purity beyond this minimum figure.

Following the letters identifying the alloy are the dash numbers indicating the diameter and length of the rivet. The first 4 means that this rivet is ⅛-inch diameter and the second -4 means it is ¼ inch in length.

Information in this article is for planning and information purposes only. It is not to be construed as authority for making changes on aircraft or equipment, or as superceding any established operational or maintenance procedures or practices. — Editor.

Are you an asset or liability to Army Aviation?

Professionalism

Captain Thomas W. Schmid

THE DIFFERENCE between the professional and the nonprofessional Army Aviator is not easily discernible. The distinction can only be made by observing the way the aviator applies his knowledge. Many, if not all, of the items that make a pilot's performance professional are basic. Let's take a look at some of the things we should strive for as professional aviators.

APPEARANCE

How many times have you gone to base operations to file for a night or weekend flight and seen other pilots wearing a flight suit with civilian shoes and socks or with a sport shirt showing under the flight suit? Besides being in violation of uniform regulations, this indicates a lack of self-pride and discipline, which in turn indicates a "What, me worry?" attitude toward flying.

Let's follow the example set by pilots who always present a neat, clean appearance and wear the proper uniform. Granted, maintaining neatness may not be possible when operating in the field for extended periods of time. But, remember, when we fly out of military and civilian airfields, we are on display before members of other services and civilians.

COURTESY

How often have you been cut out of the pattern or been forced to make a go-around because another aircraft took its good natured time clearing the active? This is quite perturbing, as is getting blasted with a cloud of sand or dust by a pilot who didn't have enough courtesy to turn the nose of his aircraft while making a runup. Besides being thoughtless, this act can cause injury to personnel and damage to other aircraft.

EMERGENCIES

Recall, back in primary, when it was necessary to have a forced landing field in sight at all times? If we didn't, the IP quietly closed the throttle to simulate a forced landing, and we found ourselves up a creek with a feathered paddle. Have we become so complacent that we find it too much of a bother to maintain this vigilance? If we aren't prepared to handle a forced landing, it's safe to assume that other inflight emergencies could end in disastrous, if not fatal, results. Foresight is better than hindsight. Let's periodically review the emergency procedures for each type aircraft we're qualified to fly. Be prepared to handle any type of emergency that might arise.

RADIO PROCEDURE

This is probably the most abused facet of aviation. The ATC section of Jeppesen lists the proper phraseology to be used in transmissions, but hardly a day goes by that we don't hear a breach of form. It seems to be the rule rather than the exception to use unnecessary and excess verbiage.

We should think of what we're going to say before we talk. For example, when making an IFR position report, it doesn't hurt to write it out beforehand. Then when it comes time to transmit, we're able to give a brief, clear, concise report without pausing with "Ah's" while we're check-

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Capt Schmid was with the Employment Division, Dept of Tactics, USAAVNS, when he wrote this article.

ing the altimeter, clock or figuring our next estimate.

Another item to keep in mind is to listen before we transmit. "Say again, you were cut out" is irritating to the transmitting parties and embarrassing to the interrupting party. The ground controllers' sole purpose is to assist the aviator. Give them your cooperation by using correct radio procedures.

CHECKLISTS

Paragraph 18, AR 95-2, C2, states: "The hazards inherent in inadequate preflight, takeoff, and landing procedures require that special attention be given to the use of pilot checklists." These are just as important to flying as navigational aids. If we fly the same type aircraft day in and day out, we've probably memorized the checklist. But, suppose we're qualified in several aircraft which we fly infrequently, or we have a desk job and just get in four hours a month? Then, it is imperative that we use a checklist to ensure that all components of the aircraft are safe for flight. Some pilots feel embarrassed if others see them using a checklist. Imagine the embarrassment of the pilot who took off from a carrier with his wings folded — or the pilot who took off and didn't notice until he was airborne that his aileron control cables were reversed!

Don't restrict the use of a checklist to preflight and takeoff checks. Prelanding checks are just as important. If you don't believe so, ask any pilot who has had the misfortune of landing with the gear up. A simple prelanding check such as GUMP (gas, undercarriage, mixture, props) will prevent such needless accidents.

AIRCRAFT CONTROL

Most aviators feel that in this area a pilot exhibits his true professionalism. It seems simple enough to fly from point A to point B and arrive safely. All Army Aviators have this capability, so how do we separate the pros from the amateurs on such a basic matter? The professional has a purpose in mind and keeps ahead of the aircraft.

For example, if the needle starts to move out of the doughnut of the course selector, he immediately applies a correction and continues to bracket until he determines the exact heading that will keep him on course. He then maintains this heading, not one or two degrees left or right. The altimeter will read his exact assigned altitude, not 50 feet above or below. When he receives a new altimeter setting he applies the "K factor" and corrects his altitude accordingly.

As the flight progresses, the professional will be checking to determine if his estimate is valid or he'll study the approach plates for his destination. He knows that he'll be too occupied to be groping for minimums and time from station to pull-up when on the actual approach. And, speaking of approach plates, he has the most current available with him — not at home in a stack of unposted changes.

PROFICIENCY

Some interpret proficiency to mean flying four hours a month for pay. Are we actually practicing anything we can't do already by flying straight and level to a point 100 miles distant, getting a cup of coffee, then returning? File IFR and shoot a few practice approaches. On the way, go on partial panel and force yourself to make compass turns. This is the time to practice, not on your annual instrument ticket renewal ride.

This type of proficiency not only puts money in our pockets but can very possibly ensure a longer life.

HONESTY

Paragraph 6e, AR 95-4, reads as follows: "Flying time for any one aerial flight starts when the aircraft begins to move forward on the takeoff run and when a helicopter comes to a hover and ends when the aircraft is on the ground and (a) the engines are stopped, or (b) the aircraft remains stationary with engines operating for a period in excess of 5 minutes, or (c) a member of the crew leaves the aircraft. Flying time will be recorded in hours and minutes to the nearest five minutes."

Do we always have this regulation in mind when logging flight time? A 30-minute flight must be logged as 30 minutes, not 45 or an hour. We violate the regulation and foul up maintenance if we log more time than is actually flown. Because of incorrect logs, an aircraft could go into PE several hours ahead of schedule, which is quite expensive in terms of manpower and money.

Also, when filling out the book, we are required to list all discrepancies noted on the aircraft that have not been written up. This includes hard landings. Sure, it's embarrassing and hurts the ego, but it is much better to have the damage, if any, repaired before something more serious happens. This action might even save the life of the next aviator who flies the aircraft.

These are just a few of the many ways in which professionalism is demonstrated. Although there is nothing complicated, it does call for constant attention, proper planning, and hours of practice. Strive for it! Let's be an asset to our chosen profession.

Want a new, easy and simple way to fold maps that you can safely manage in an overcrowded cockpit? Here's how it can be done. Try it.

MAPS

Captain Thomas A. Sands

DURING A field exercise, a reconnaissance helicopter was dispatched from the airfield to the division command post to pick up an observer and perform a routine reconnaissance mission. The observer, complete with binoculars and mapboard, climbed into the helicopter. The aircraft lifted slowly from the helipad. Suddenly, the aircraft faltered and struck a tree, completely destroying the aircraft and injuring both pilot and observer.

The cause? The mapboard the observer was carrying in his lap had jammed against the cyclic control stick, and the pilot was unable to control the aircraft. This is what may be called learning a lesson the hard way. Large mapboards are unsuitable for use in aircraft. Although they are moderately easy to use, they are too large and too cumbersome to handle properly in the aircraft.

To be effectively used by an observer in an Army reconnaissance aircraft, a map must meet the following criteria:

It must be folded into a relatively compact size.

It must be easily unfolded and refolded so the observer can quickly move from one section of the map to another.

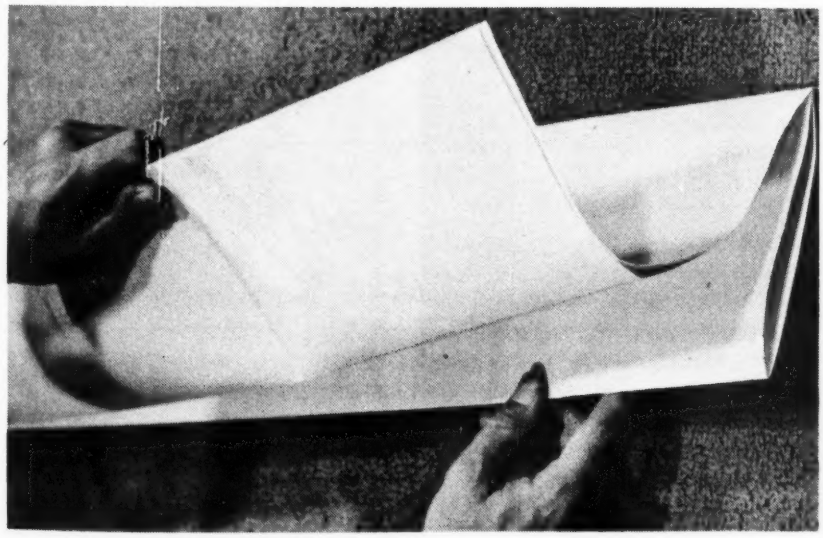
There is no trouble in meeting the first criteria as we can fold any map as small as we please. The problem is in folding the map to allow the observer to look at any portion of his map without having to completely unfold and refold it.

The following procedure for folding maps is used extensively by some aviation units and meets the established criteria. This procedure will work for a single map sheet or a series of map sheets.

Orient your map in the normal manner with north at the top.

Fold the map in half (south to north), then fold it into thirds (fig. 1). This divides the map into six equal folds.

Figure 1



Capt Sands is assigned to the 65th Engineer Bn, APO 25, New York, N. Y.

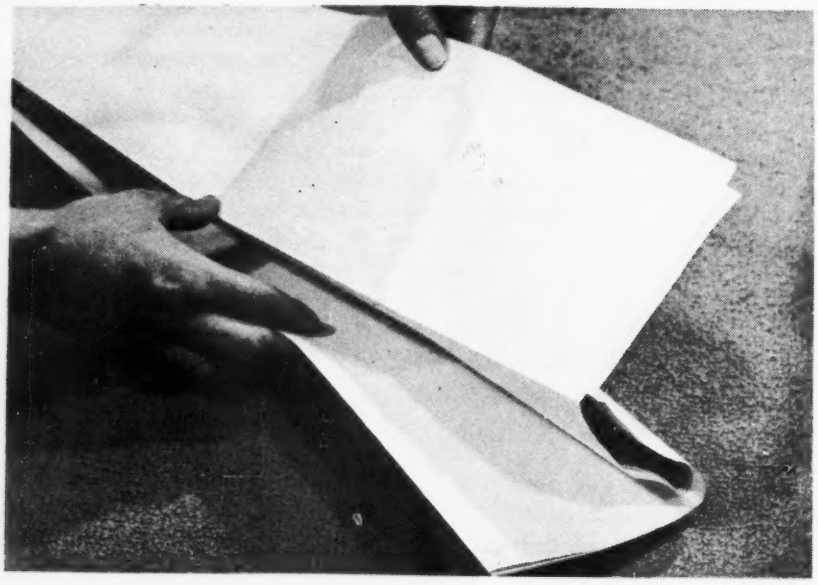


Figure 2

Reorient the map as in step one and fold in half (west over east). Again fold the map into thirds (fig. 2). The map is now divided into 36 equal sections.

Cut along the folds, two sections from each side and one section from the top and bottom (fig. 3).

Fold the map in accordion fashion as shown in figure 4; face 2 over face 1, face 4 over face 3, and face 6 over face 5.

Open the map so face 3 and face 4 are showing and fold the map as in step 5, except in the west-east direction (fig. 5).

The map is now folded into 1/18 the size of the original map sheet (fig. 6).

A hard cover of some type may be attached to the folded map for protection and ease of handling.

Opening the folded map to the center fold, which is the center

Figure 3

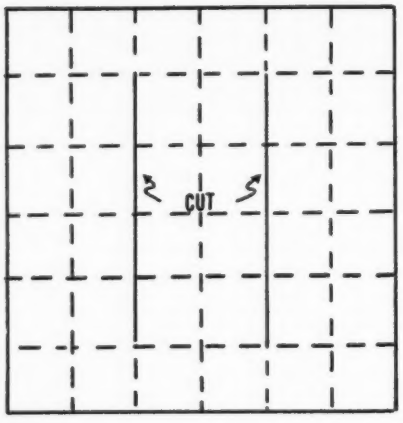


Figure 4

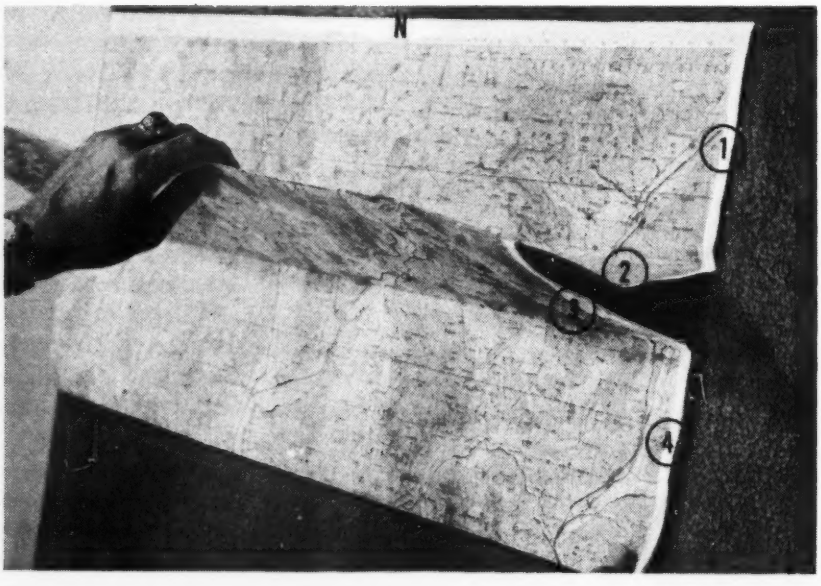
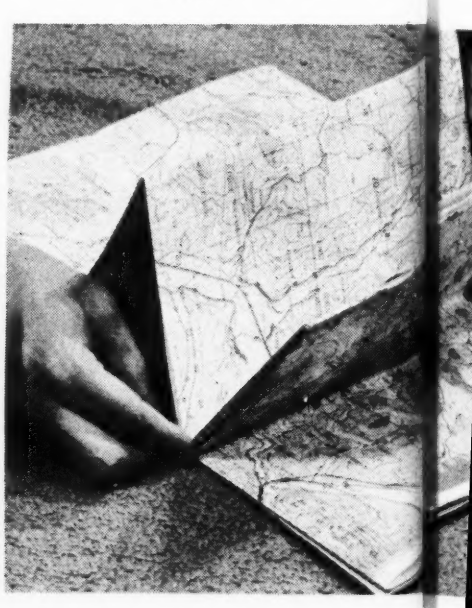


Figure 5



of the map sheet, you will see that you can read 1/9 the area of the map at any one time (fig. 7). It is a simple matter to turn from one part of the map to another while still maintaining a map 1/9 the size of the original map sheet. To go from one fold to another, you always go through the center folds.

For example, if you desire to use section 1 (fig. 8), you open the map to the center (fig. 7), move to section 2, then to section 1. If you were using section 1 and desired to go to section 9, you would simply turn back to section 2, then through the center (section 5), to section 8, and finally across to section 9.

As you can see this method of folding is rather simple, and it will seem even simpler once you have tried it yourself. It is certainly compact and requires no effort to maneuver from one section of the map to the other.

If the observer mentioned above had been carrying a map folded in the manner described, the Army would have one more helicopter today.

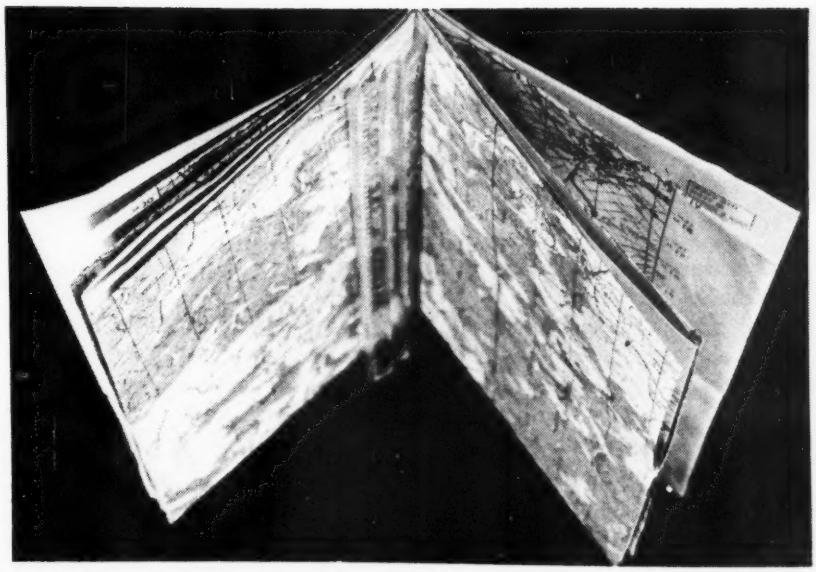
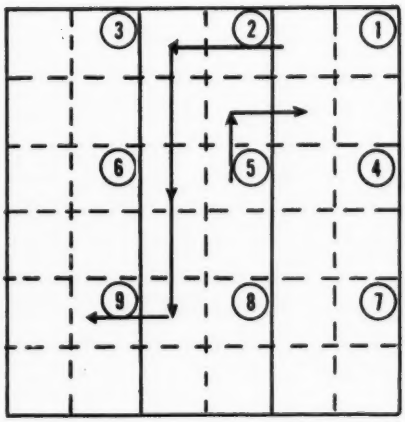


Figure 6

Figure 7

Figure 8



From Bragg to Hood to the Republic of Vietnam

HU-1 CP A SUCCESS

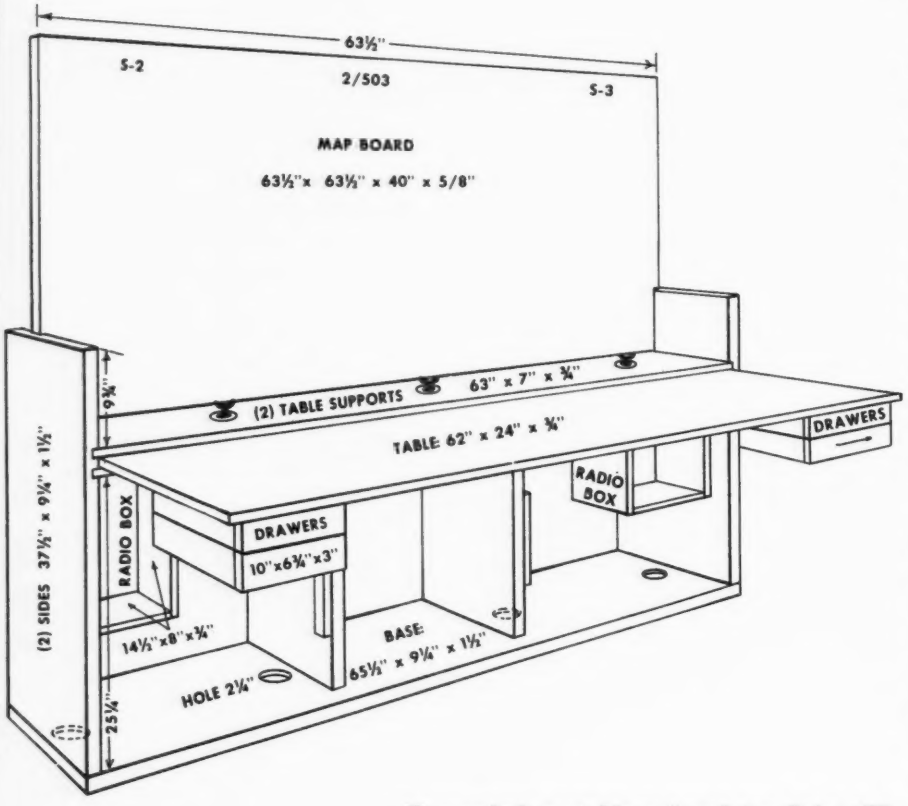
LAST SUMMER, Brig Gen Keith L. Ware, assistant division commander, 2d Armored Division, asked the AVIATION DIGEST to send him material pertaining to the article "Flying Command Post" (see DIGEST, Nov 1960). It was used to assist in the construction and operation of a similar CP in preparation for Operation BIG LIFT.

The project proved to be a success, as indicated in a letter recently received from General Ware's office:

"We have constructed a modified version of the CP which has performed satisfactorily both here at Fort Hood and in Germany during exercise 'Big Lift'. Its range and mobility have proven to be of valuable assistance in controlling the wide front of a fast moving armored division.

"In the beginning stages now are further modifications which should allow dependable communications and a simplicity of operation that did not exist in our original model. Pending availability of a UH-1, we hope to try out our most recent changes during exercise 'Desert Strike'.

"I hope we have not inconvenienced you by keeping the material for too long, but I can assure you it has been put to good use. With the guidance furnished plus our subsequent experience gained, we have provided further information on the construction of the CP to the 8th Infantry Division in Europe and a military assistance group in Vietnam."



Economical, portable pedestal for flying CP

Incipient Engine Failure

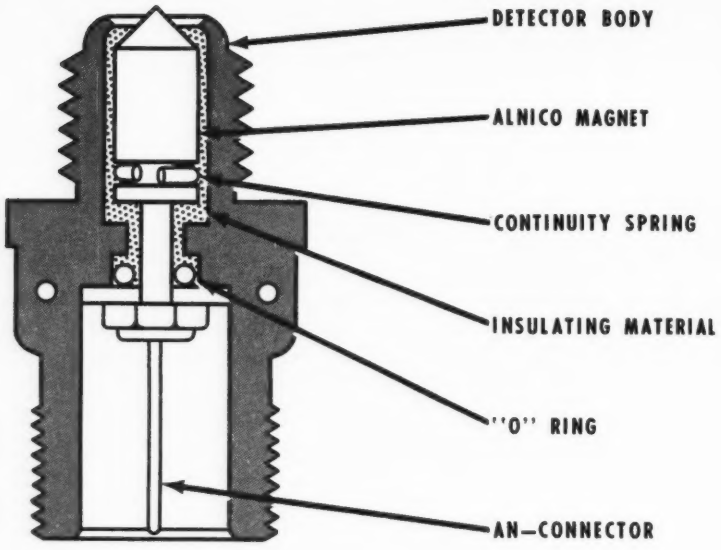
Captain Robert W. Newton

SINCE THE FIRST days of powered flight, engineers have searched for accurate means to predict engine life and failure. With a vast backlog of experience, we can now do a fair job of predicting average engine life. But these predictions are based on given operating conditions. Like your insurance agent's life-expectancy tables, we can only tell how many will reach a given age. Insurance actuaries can't point to specific policyholders and say one will die at 40 and another live to 65. Neither can we point to specific engines and predict the exact operating hour of failure. This works out fine for insurance, but it's a major hazard to flight.

Engine failures were frequent in the early days of flying, often with disastrous results. Today's engines are far more reliable and stand a much better chance of reaching life-expectancy without failure, *providing they are operated and maintained by the book.*

But what about those engines subjected to overboosts without writeups, those operated at high rpm and low temperatures by impatient pilots and mechanics, those mistreated or poorly maintained in any of a hundred other ways, or those manufactured

"Engine, engine, how long will you last? Engine, engine when will you fail?"



Magnetic field and correct air gap created between Alnico magnet (2) and detector body (1). Magnetic field forces particles to bridge gap between magnet and body. Insulation material (4) separates detector body and magnet. "O" ring (5) seals the detector against oil leakage. AN-type connector (6) provided for check with continuity tester or for permanent wiring to cockpit warning light. This type designed for ground return wiring system. Continuity spring (3) assures electrical contact regardless of expansion or contraction due to heat or cold.

ENGINE FAILURE MISHAPS

1 July 1961 - 31 Dec 1963

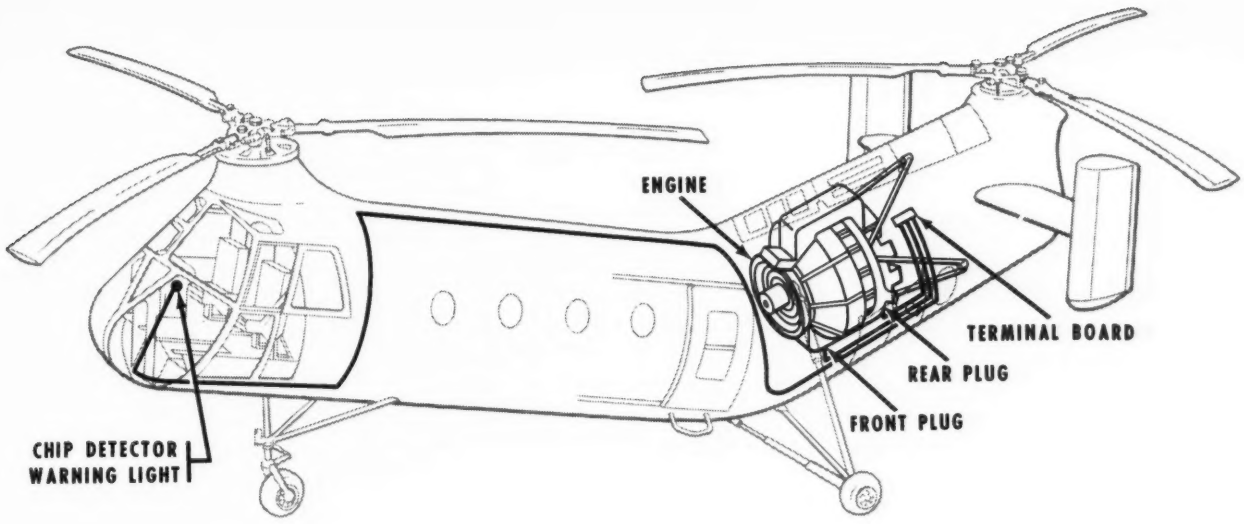
TYPE A/C	TYPE MISHAP				TOTAL FAILURES	FAILURE RATE PER 100,000 FLYING HRS.
	MAJOR	MINOR	INCIDENT	FORCED LANDING		
O-1	25	1	2	72	100	11.2
U-6	4	1	3	36	44	8.9
U-1A	4	1	0	23	28	25.0
U-8	3	0	0	35	38	8.2
CV-2	0	0	0	6	6	8.5
TOTAL	36	3	5	172	216	
OH-13	20	2	8	104	134	37.6
OH-23	9	2	4	37	52	13.7
UH-19	5	0	1	60	66	45.6
CH-21	13	0	6	115	134	122.7
CH-34	8	0	4	47	59	28.5
CH-37	0	0	1	23	24	37.5
TOTAL	55	4	24	386	469	

or overhauled with defective parts? Like the man who burns his candle at both ends, these engines are subject to failure at any time before they reach normal life expectancy. For a recent example, see "Crash Sense," DIGEST, April 1964.

Several new methods developed during the past few years promise more accurate predictions of engine failure. Two of these, spectrographic oil analysis and magnetic chip detectors, test engine oil in much the same way that doctors test blood.

[See DIGEST Aug 60, inside back; Dec 60, p14; and Aug 62 p32 for more on this subject.]

From a sample of engine oil, spectrographic analysis tells us what traces of metal may be present and how much of the metal. By taking several samples over a period of time, analysts can chart the rate of wear for specific engine parts. This wear is charted for each oil sample, and when a part shows wear beyond the normal, corrective action is indicated. This corrective action may consist of replacing the engine or the affected part or parts. Experienced spectro-



graphic analysts can sometimes identify impending failures with a single reading.

Magnetic chip detectors trap metal particles from the oil. These particles may be present due to normal wear, or they may indicate the start of material failure in some engine part. Metal particles found may be any of five kinds: steel, tin, aluminum, silver, and copper (or bronze). By identifying the metal, we can tell which part it came from. And by determining the size and number of particles, we can tell whether it is caused by normal wear or whether it is an indication of impending failure.

Methods of identifying metal particles and their significance are listed in paragraphs 3-22 through 3-36, Chapter 2, Section III, TM 55-1510-201-20. A recent CH-21C forced landing reported to USABAAR proves the value of this system. The chip detector light came on at 3,000 feet. Maintaining 2500 rpm and 20" manifold pressure, the pilot landed the aircraft *and the engine failed at touchdown.*

Army aircraft accident statistics for the period 1 July 1961 - 30 December 1963 show the magnitude of the problem of accidents caused by engine failures. USABAAR records reveal that 13 percent of all major accidents during that time were the result of engine failures.

Spectrographic oil analysis should indicate impending failures sooner than chip detectors, except for those failures caused by fatigue, since excessive wear usually comes before metal particles large enough to be captured by chip detectors are present. But a major disadvantage to this system is time delays. There are delays between the time oil samples are taken, sent to the lab, compared with old samples, and word is sent to units warning that trouble is developing. Also, the time interval between taking samples (15-25 flying hours) means that oil analysis only gives notice of impending trouble every 5 hours, at best, and every 30 hours, at worst. If the nature of a failure is such that its duration is only 5 hours in length, there is a good chance spectrographic analysis would miss it.

Magnetic chip detectors, coupled by closed circuits with warning lights in cockpits (see drawings), provide continuous inflight monitoring of engines. When the gap between the two terminals of a magnetic chip detector plug is closed by metal particles drawn to the plug by its magnetism, the warning light in the cockpit goes on. While the warning light will not give as much warning as spectrographic oil analysis, it is the only device that will give instantaneous warning of an impending failure.

The ideal solution would be to have a complete oil analysis program and chip detector warning lights in all aircraft. The chip detector provides instantaneous warning of sudden-type failures and fatigue failures, which are missed by oil analysis; and the oil analysis program warns of failures 5-100 hours in advance.

The Air Force found that almost 65 percent of its aircraft destroyed with material failure was caused by engine failures.

Capt Newton is a member of the Human Factors and Engineering Division, USABAAR.

Approximately 20 percent of Army aircraft destroyed with material failure was caused by engine failures.

Starting in 1960, the Air Force installed chip detector warning lights in T-28 aircraft as called for by HIAD (Handbook of Instruction for Aircraft Designers). It has since installed these systems to monitor all helicopter engines and transmissions. HIAD calls for warning lights to monitor engines and transmissions of helicopters equipped with either reciprocating or gas turbine engines.

The Navy installed warning lights in several aircraft during late 1959 and early 1960. After the systems were in service, a survey of reported inflight warnings was made. This survey showed:

Fifty-five percent of all reports disclosed metal contamination to the extent that the engines were removed.

Thirty percent reported positive findings, but not to the extent requiring engine change.

Fifteen percent reported negative findings attributed mostly to electrical malfunctions.

With improved maintenance to reduce the number of false indications, the Navy was able to increase the reliability of the system. It has since installed warning lights in all piston driven aircraft, except the C-45. The system was not considered necessary for the C-45 because of its more reliable engines.

Chip detector warning lights were installed in all Army CH-21 aircraft during 1961. The CH-21 was chosen because its history showed more engine failures than any other type Army aircraft. A recent survey of several CH-21 companies showed:

Standard procedure when the warning light came on was to land at the nearest suitable field and make an inspection.

Seventy-five percent of the cases in which the light came on proved to be accurate indication of impending engine failures.

Twenty-five percent of the cases reported proved to be false indications. Many of these were caused by humid climates.

Improved maintenance can reduce the number of false indications.

The past experience of the three services proves the chip detector warning light to be a cheap, reliable, and entirely worthwhile warning device for piston engines, transmissions, and gear boxes.

Except for OV-1 engines, which are being modified, there have been no problems with any Army turbine engines that chip detectors would help to solve. Most engine and airframe manufacturers take the position that warning lights would serve no useful purpose for our turbine engines, since chip detectors can only monitor engine bearings and accessory gear systems. However this may not remain true as new and different type aircraft (LOH and CH-47) come into the inventory.

To find out how many additional Army aircraft have warning lights installed, a survey was made. The survey included those aircraft for which MWOs calling for chip detector warning light installation have been published. From a 50 percent response, the survey showed the following percentages of aircraft with warning lights installed as of 1 January 1964:

U-6A - 38%
U-1A - 50%
UH-19D - 75%
CH-37 - 0%

Several of the MWOs for these aircraft have been published for almost two years. The usual reason given for failure to install warning lights is lack of parts. These parts consist of *only a few lengths of wire* and the installation requires but a few man-hours.

It is hoped that the majority of piston engine aircraft will be equipped with chip detector warning lights during 1964. If they are, we can count on a marked decrease in major accidents caused by engine failures.

What to do if light comes on in flight

ROTARY WING
A normal landing should be made at the nearest available safe landing area (open field, etc.).

FIXED WING
A normal landing should be made at the nearest airport. If the flight is IFR, an approach should be made to the nearest facility. In ALL cases, maintenance should be notified and the cause determined.

TYPE AND LOCATION OF MAGNETIC CHIP DETECTOR PLUGS

TYPE A/C	ENGINE OR TYPE GEAR BOX	MAGNETIC PLUG INSTALLED	WARNING LIGHT IN COCKPIT	MWO OR TM	DATE OR PROPOSED DATE	TIME COMP-LIANCE
O-1	O-470	*Yes	No	Not Yet Published	Apr 64	
U-6A	R-985	Yes	Yes	TM 1-1U-6A-1029	4 Mar 63	90 days
U-1A	R-3140	Yes	Yes	TM 1-1U-1A-1039	8 May 62	90 days
U-8D	O-480	Yes	Yes	MWO 55-1510-201-24/3	Mar 64	
CV-2	R-2000-13	Yes	Yes	Not Yet Published	Mar 64	
OH-13	O-435	*Yes	*Yes	Not Yet Published	Jan 64	
	Main	No	No			
	Tail	No	No			
OH-23	O-435	*Yes	*Yes	Not Yet Published	Jan 64	
	Main	No	No			
	Tail	No	No			
UH-19D	R-1300-3	Yes	Yes	MWO 55-1520-201-34/1	19 Mar 62	180 days
	Main	Yes	No			
	Intermediate	No	No			
	Tail	No	No			
CH-21	R-1820-103	Yes	Yes	TM 1-H-21C-1023	27 Oct 60	90 days
	Forward	Yes	No			
	Central	Yes	No			
	Aft	Yes	No			
CH-34	R-1820-84	Yes	Yes	MWO 55-1520-202-34/16	10 Jan 64	90 days
	Main	Yes	No			
	Intermediate	Yes	No			
	Tail	Yes	No			
CH-37	R-2800	Yes	Yes	MWO 55-1520-203-34/12	16 May 63	90 days
	Main	Yes	Yes			
	Intermediate	Yes	No			
	and Tail					

*To be installed when MWO is published.

THE NCR BEACON

. . . a crash position locator that can save your life

Ted Kontos

SLIGHTLY LARGER than a king size package of cigarettes, the NCR transmitter puts out a pulsating bullfrog signal that can be heard up to 100 miles. Powered by self-contained batteries, it transmits on a preset frequency of 60-400 mc, with a peak power output of 750 mw. Modulation is accomplished by a pulsed carrier which is swept at 300-1,000 CPS at a 2½ CPS rate. Developed by the National Cash Register Company, it is called the NCR Rescue Beacon.

A look at a few accident briefs clearly shows the need for such a device:

In one instance, a two-place aircraft on a cross-country flew into instrument conditions and struck a mountain. Neither of the occupants was seriously injured. But the wreckage was not located for over 2 months, and both occupants died from exposure.

Another accident closely parallels the first one. In this instance, a light aircraft was downed in a snowstorm. The two occupants survived the crash. Although a thorough search was initiated the following morning, the accident site was not located for over 2 months. These men kept a diary while awaiting rescue, and it was determined that they died from exposure after 4 days.

Another aircraft struck the side of a hill, and the wreckage was not located for over 10 months. Again, there were no survivors.

Two crewmen became separated when they ejected over jungle terrain. After wandering in a state of shock for nearly 3 days, the pilot was spotted and rescued. The second crewman was never found.

Although these are just a few brief instances, they plainly show the inadequacy of present-day methods of locating downed aircraft and survivors. Nor is this problem unique with the military services. Civil aviation agencies are also plagued with it. During 1962, the Air Rescue Service initiated searches for 254 military and civilian aircraft. The Civil Air Patrol (CAP), as well as the various military services, participated in these search missions.

In an effort to locate these downed aircraft, 12,373 sorties and a total of 25,975 hours were flown. More than 60 percent of this search effort was flown by the CAP. Excluding the military services, the cost for fuel used by the CAP amounted to more than $60,000. Of the 801 persons aboard the lost aircraft, 335 were found alive, 408 had perished, and 58 were never found. Six additional lives were lost during emergency or practice search missions. This loss of life and expenditure of money and time could have been greatly reduced by use of reliable crash position locator equipment.

Experience has shown that prompt location of downed aircraft and timely arrival of rescue teams is an important factor in the survival of aircraft crews and passengers. In numerous cases, well organized search and rescue operations have failed to locate a downed aircraft in time to render necessary assistance. This is true even in accessible, populated areas of the world. The problem becomes more complex when aircraft are operated over sparsely settled, inaccessible terrain.

A reliable radio crash locator beacon appears to offer the best solution. Capable of transmitting an automatic signal over a distress frequency, it can replace with immediate alerts our present system of waiting until aircraft are overdue. It would relieve rescue crews of the necessity to rely on visual search methods. Searches could be made during periods of adverse weather. Locator beacon signals could be detected in such weather by search aircraft equipped for instrument flight. Crash locations could then be relayed to ground search parties or boats. This would overcome the present necessity for stopping visual searches during bad weather and during the hours of darkness.

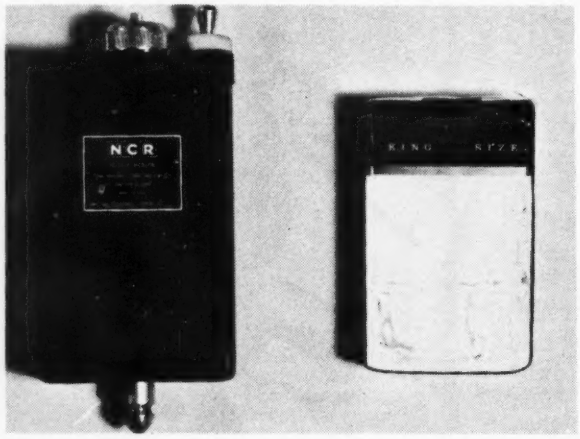
Even in those accidents with no survivors, the ability to locate quickly a downed aircraft often results in determining ac-

cident cause factors *before* clues are lost. Many mysteries might be solved involving crashes where aircraft are never found.

Among civilian agencies, the Flight Safety Foundation has for several years sought development of a practical crash position locator for business aircraft and private plane users. In 1961, in cooperation with New York state aviation officials, the Flight Safety Foundation sponsored an exploratory general aviation crash location conference. Representatives from the military services, federal and state aviation agencies, manufacturers, private flying associations, and airlines attended this meeting. Not only was there full agreement that a crash position locator was sorely needed, but a set of tentative specifications was suggested.

Since that time, numerous manufacturers have developed a variety of crash position locators and have improved earlier designs. Some of the latest equipment has already been placed in service by the U. S. Air Force, the U. S. Navy, and other agencies. For the most part, however, these units are bulky and designed primarily for installation on larger aircraft. A light, portable, highly versatile device that could be used by smaller aircraft and individuals was needed.

The NCR beacon occupies a space of 13½ inches and weighs 12 ounces. It can be carried on an individual or included in his survival kit. For manual operation, the user extends the telescoping antenna and turns on the set. The same unit can be provided in a different configuration, designed to give immediate and automatic operation in event of bailout or ejection. A special switch permits activation of the unit by the parachute riser, which also withdraws and supports a flexible wire antenna as the chute opens. A third possible configuration would permit the unit to be mounted in aircraft. Insulated against heat and shock, and buoyant enough to float, the NCR beacon would be automatically ejected and set in operation at impact. In each instance, a manual override switch can either turn the transmitter off or prevent its activation.



During operation, the unit transmits on its preset frequency with a peak power output of 750 mw, enabling rescue aircraft to pick up an audible tone from a distance of 100 nautical miles at 10,000 feet. Once the audible tone is received, a search pattern is flown until the aircraft is within 60 nautical miles. At this point, ADF equipment can be used to home in on the signal and guide searchers to the exact spot. Since the frequency and power output of the unit are not compatible with ADF equipment presently installed in Army aircraft, modification of this equipment would be necessary.

In the event that no other aircraft happens to be within a 100-mile range, the search would begin when the downed aircraft was missed or declared overdue. Operating in the general vicinity of the crash, search aircraft would fly 200 miles apart. Each would electronically scan a path 200 miles wide until a signal was heard.

Aside from its compact size and high power output, the beacon can be stored at temperatures ranging from —54° C to +55° C, and will function within a temperature range of —30° C to +55° C.

The power source for the transmitter is a low-cost, commercially available battery which operates continuously for a minimum of 24 hours at 0° C. After 24 hours of operation at this temperature, the unit will continue to function with a minimum power output of 200 mw. Even at 60 percent below initial battery voltage, the beacon will transmit with a power output of 100 mw.

Some other advantages of the NCR beacon are:

It is one of the smallest, lightest, and most powerful units of its kind.

It has exceeded all specifications by an average of 183 percent. One specification, power output at 30 percent reduction in battery voltage, was exceeded by 500 percent.

It is presently available and ready for production.

It has already been flight tested by the Air Force.

Designed specifically for search and rescue work, the NCR Rescue Beacon is not limited to this function. With slight modifications to the packaging and power supply, it can be used as a marker beacon, buoy locator, target drone, missile indicator, etc. The cost, when purchased in quantity lots, is estimated to be approximately $75.00 per unit for the manually activated personnel model.

crash sense

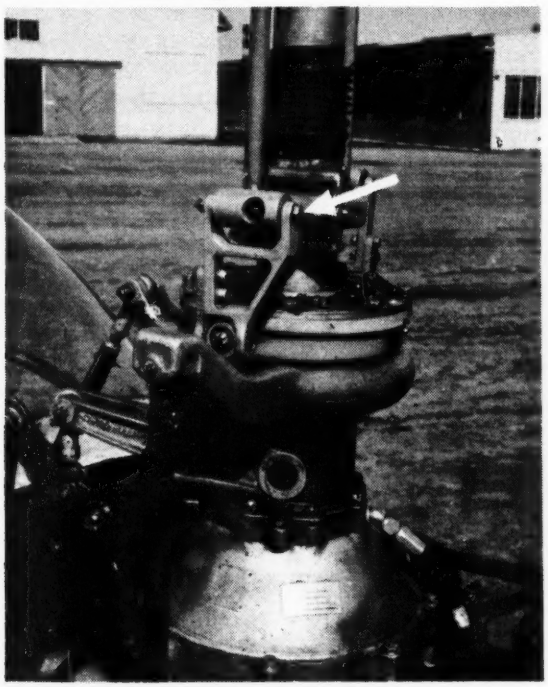
PREPARED BY THE U. S. ARMY BOARD FOR AVIATION ACCIDENT RESEARCH

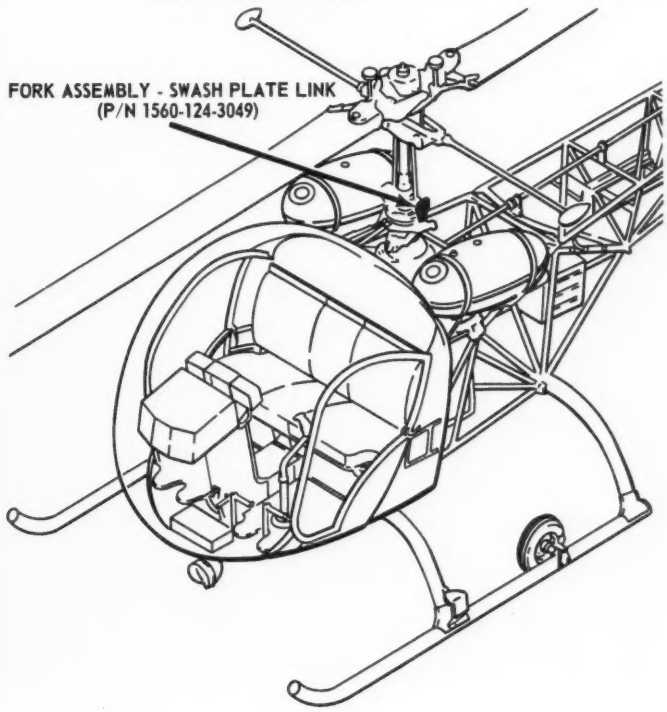
MISSING BOLT

Photos and diagram show bolt location and installation. Photo of wreckage shows open linkage.

It's happened again! In past issues of CRASH SENSE (May 61, Jul 62, Sep 62) we described accidents involving missing cotter pins and bolts from control linkages. This time it was an OH-13G which crashed to destruction, killing the pilot.

During the investigation, the bolt (FSN 5306-151-0322) which connects the flight control scissor arm assembly to the swash plate link fork assembly could not be





MISSING BOLT

found. Analysis of the scissor arm and fork assemblies proved the scissor arm had been misaligned. This caused abnormal loads to be placed on the bolt, and it is suspected that the bolt failed in fatigue. According to the personnel who performed the analysis, the misalignment could have resulted from improper placement of shims between the scissor arm and bracket assemblies to provide the required clearance.

The why of this accident is an echo of previous maintenance caused accidents. Hindsight tells us that if the proper form entries had been made on DA Form 2408-13, stating that work had been performed on the flight control system, this accident could have been avoided. TM 38-750-1, "The Army Equipment Record System and Procedures," covers general rules for proper DA Form 2408 entries. It specifically provides information about the requirements for RED X entries.

The old rule still applies — if the removal of parts or assemblies is such that improper reinstallation could create a hazard, the Red X will be entered on DA Form 2408-13 to ensure an inspection by the aircraft maintenance supervisor or other qualified inspection personnel designated by the aircraft maintenance officer. TF 46-3399, "A Form, a Red X, and You," is now available in Army film libraries. It should be shown to all maintenance personnel.

SHARE ITS

near accident and flight hazard reports

OV-1

"During my return flight from a stagefield, I called the tower for weather and was advised of an 8,000-foot overcast, 2½ miles visibility. I contacted approach control and received an IFR clearance for radar vector to GCA final approach. Soon, I was told that a U-6A was on approach. I could not locate the U-6A and advised GCA. At this time, I located the traffic and saw that the pilot of the U-6A was making a left turn into me. I took evasive action to avoid a collision."

U-6A

"While flying straight and level at 1,900 feet MSL, I saw a jet fighter bomber heading toward me at about one mile on a direct collision course. Each of us gave way to the right and passed approximately 200 yards apart at such closure speed that a violent bank was required by both aircraft."

U-6A

"While taxiing out for a controlled VFR departure, the tower asked if I was ready to go. I told them that I was not and began my ground check. Just as I completed the check, the tower asked me again if I was ready to depart. I told them I was, and ATC then gave me clearance to depart the control zone SW, stay below 2,500 feet, and maintain special VFR. On receiving this message, I pulled out on the runway and took off. After breaking ground, I was told to make a right turn to 230° and was informed that I had not been cleared for takeoff as an aircraft was on one mile final.

"I realized that I had made a mistake in taking off with an ATC clearance instead of a tower clearance. However, if the transmitters had been left on, I could have heard the conversation to the aircraft that was landing. As it was, I thought the tower was trying to get me going because of a Convair running up behind me."

CV-2B

"While holding at 7,000 feet at an intersection, I was cleared to climb and maintain 8,000 feet. After receiving my climb instruction, another CV-2B was cleared to climb and maintain 9,000 feet. One minute northeast of the intersection, our two aircraft passed within 300 feet of each other. In that area, we were in and out of clouds, and the visibility ranged from zero to two miles in light rain and snow showers. Fortunately, when the near-accident occurred, we were able to see each other. In order to avoid a collision, both of us performed evasive maneuvers. Each aircraft was on an IFR flight plan with an ATC clearance."

U-6A

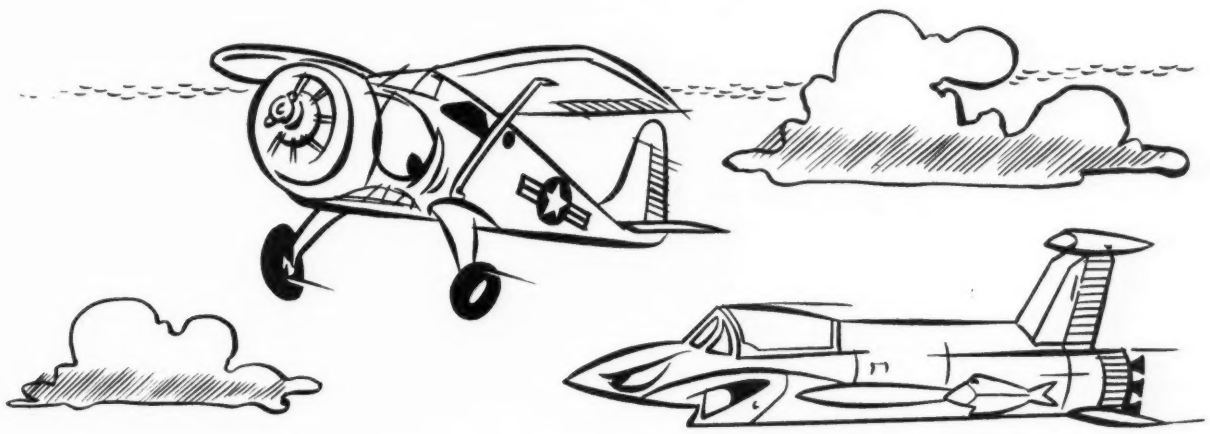
"I was flying in a control zone and had radio contact with the proper approach controller. Two jet fighters passed approximately 500 feet under me. These jets had not reported to the controller; nor did he know that they were in his control zone. This problem is becoming more and more serious as the number of aircraft in this area increases."

O-1E

"While returning to my home base, I called for landing instructions. I was midway on the downwind leg when I observed a jet fighter converging from my left at the same altitude. After climbing abruptly to avoid the jet, I saw him pass slightly in front and beneath me as he turned on his afterburner and climbed. After landing, I found the tower had no prior knowledge of the jet's presence in our traffic pattern. This is one of many low flying jet aircraft we have had in our immediate area without prior knowledge."

U-8F

"We were practicing instrument approaches under positive radar control and being vectored to the ILS final approach course. We were at an assigned altitude of 2,000 feet and were maintaining a heading of 270°. While being vectored to intercept the approach course in clear VFR conditions, approach control advised us of a target at two o'clock southeast bound. The target was identified as a C-121 (Constellation) which had apparently just taken off and, after a right turn, was in the process of climbing on course. Proximity of the C-121 necessitated evasive action in the form of a 90° turn to the right, using 90° of bank.



"After completion of evasive action, we saw the C-121 continue on course through our altitude without altering its heading in the slightest. The Constellation's coloring blended with the ocean over which the flight was conducted, and it was not seen prior to being mentioned by the approach controller. By local agreement, aircraft operating from this station are required to be at an altitude not to exceed 1,500 feet, which places aircraft performing instrument practice 2,000 feet clear of arriving and departing aircraft. Projecting the flight lines of the two aircraft involved, it is readily apparent that if evasive action had not been taken, a mid-air collision would have occurred."

CH-37B

"Loaded almost to capacity, we were at one end of a 30-acre field. A flight of four UH-1s landed well behind us. Because of the slope of the field,

vegetation, and our heavy load, hovering turns were impractical, and we performed a visual clearance prior to take off. As we climbed about 30 feet in the air, the flight of UH-1s took off and flew directly over us, forcing us toward the ground and almost into a line of trees. Only luck kept us from striking the trees or the UH-1s. The wind was calm and the UH-1s could have taken off in any direction. Instead, they chose to take off as we did, overtook us, and nearly caused a major accident."

U-6A

"During a service flight, I was cleared IFR. Shortly afterwards, I saw an unidentified jet, low and to my left, climbing toward me. As the jet closed in, I was forced to take violent evasive action to prevent a collision. Clearance between our aircraft was approximately 50 feet as the jet passed."

UH-1B

"During a practice GCA approach, I was advised of an aircraft ahead of me. I made visual contact with the aircraft, which was flying toward me at a lower altitude. Suddenly the aircraft pulled up and headed directly for me. I took the controls away from the pilot, who was flying hood, and made a 90° turn to the right to avoid a collision."

CH-37

"I was the instructor pilot on a training flight with a transition student who had very little time in this type aircraft. I had just begun to perform a prelanding cockpit check for the pilot when an object caught my eye. It was approaching us from an almost head-on direction. I took control and made a climbing right turn. A fighter aircraft then passed under us about 100-150 feet away. This pass was made below traffic pattern altitude, across the east end of the active runway."

O-1A

"During a routine flight, I was approximately 1,200 feet above the ground when I noticed movement to my left. Before I could take any action, two jet aircraft passed approximately 200 feet below me. Both bore camouflage markings and were extremely difficult to see."

U-6A

"I was on a local VFR flight plan. Our home field has no tower in operation, but it is standard procedure to make a blind radio call on the published FM or VHF before entering traffic. I had made this call and was on downwind when I saw a U-1A Otter on a collision course with me. He was flying along the highway that runs right by our field. I took immediate evasive action. The pilot of the U-1A apparently never saw me as he continued his straight and level course and made no radio call."

TO-1D

"I was giving a TO-1D proficiency checkride and was demonstrating landing techniques. On short final of my third landing approach, I saw a U-6A coming from the opposite direction. I made a climbing right turn and the U-6A did the same. I had made a blanket call on UHF channel 1 prior to the first landing. If the U-6A called prior to landing, neither of us heard him."

O-1A

"I was returning to my home base and had been airborne for 2½ hours of a scheduled 3-hour flight. I was flying at 1,500 feet indicated on a heading of 070°. The time was 1515Z and official sunset was 1537Z. The sun was at my back and there were no clouds in the sky. The only obstruction to visibility was haze. I could see approximately 4 miles on my heading, and the haze layer extended to approximately 3,000 feet.

"I had just told my passenger that we should watch for other aircraft because I had always seen them following the highway or railroad tracks just ahead. . .

". . . I looked in front and there, coming directly at me, was an airplane. The silhouette was such that I knew I was looking at the front or back, and the wing appeared as a thin line. I instinctively applied rudder and aileron, pushed forward on the stick, and closed the throttle. The other aircraft passed within a few feet of my wingtip.

". . . My airspeed was 87 knots. Assuming the other aircraft's speed to be the same, our rate of closure was 295 feet per second. This is not much time to realize you are on a collision course, put in a correction, and have the aircraft respond. Although we missed this aircraft, not many seconds were left. The other aircraft appeared to be a Cessna type, with tricycle gear, wheel skirts, high wing, and brown and white in color. I only saw one person on the right side. By this time, I was in a steep banking dive. I recovered and turned to a heading of 250°. Then I saw why the other pilot did not see me. The sun was setting, but in shining through the haze on the plexiglas windscreen, it completely blocked forward visibility. Visibility to each side was at least 4 miles.

"How did this near-miss occur? I wish that I had the clear-cut answer to this question. The passenger and I were both looking around for other aircraft. I was flying at a low altitude to be below airways. I had just completed scaning from left to right when I saw the other aircraft. The passenger did not see it until I pointed it out after our diving turn. I feel sure he was observing because he had pointed out several other aircraft on the earlier leg of the flight.

"I assume the other aircraft took off from a small field in front of me. The background of green trees and haze would make it difficult for me to be attracted to it. It had no lights that I can remember. I had my beacon light on and it was operating. It is possible that it climbed out on a collision course and had just leveled off when I saw it. If this was the case, the pilot could have been busy with some cockpit procedure. My flight path for the 15 minutes prior had been straight and level on the same heading.

"How can we prevent this type of near-accident? We must always keep our head on a swivel when VFR. We should use radar whenever it is available. Avoid flying the same heading for long periods and bank and turn at intervals. Try to picture yourself as you would look to an aircraft coming the other way. . . . Try to avoid the altitudes below 3,000 feet whenever possible. At these altitudes, headings do not necessarily provide separation. Discuss these and other methods with your fellow aviators. We may all benefit."

UH-1B

"I called the control tower for clearance to pass through the control area at 1,000 feet. I was cleared and advised of the traffic. My crewchief suddenly saw an OH-13 on a collision course with us, and reached for the bleed air switch as I veered right and applied aft cyclic and pitch. Due to the sudden application of collective pitch, a compressor stall occurred. The aircraft made one or two abrupt pitch and yaw movements, then smoothed out long enough for us to make an immediate precautionary landing."

CH-21C

"While flying late in the evening, a Navion suddenly appeared to our right on a collision course. We immediately made a tight descending turn to the right and dived approximately 200 feet to evade this aircraft. The Navion flew out of the sun, which was on the same level as our aircraft, and we barely saw it in time. Although he should have seen us, the pilot of the Navion gave no indication that he had."

U-6A

"During a cross-country flight, I saw a C-45 aircraft to my right, at the same altitude, heading in my direction. Both aircraft took immediate evasive action.

"I reported my position to the nearest station, informed them of the near miss, and asked if they had any contact with the C-45. I was given a negative reply and the current altimeter setting. I set this on my altimeter and found that I was actually about 50 feet lower than with the altimeter setting I was using from the last facility from which I could get an altimeter setting.

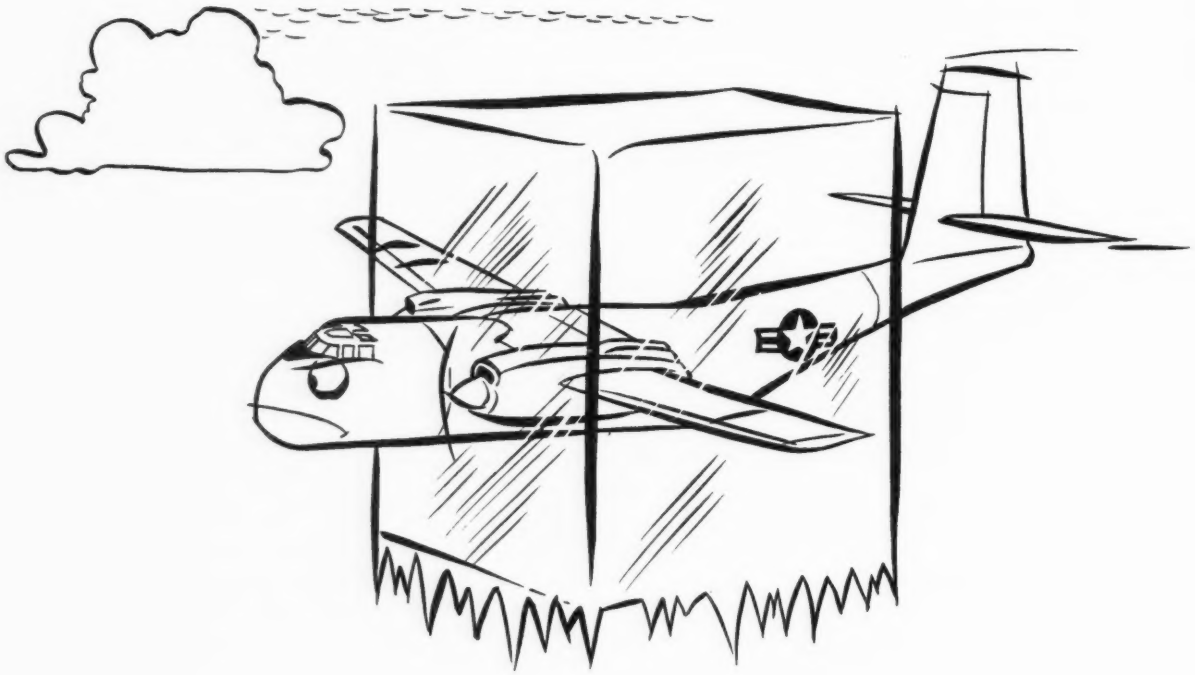
"The station then informed me that the C-45 had informed the Center that he and I were both at 5,000 feet. I assured the station that our actual altitude was much nearer 5,500 feet at the time.

"On landing, I checked my altimeter with the current setting at the field, and found that the altimeter read within 30 feet of field elevation with the current setting.

"The C-45 approached in the blindest spot of the U-6A, but the other pilot should have been able to see me for at least 5 miles, as visibility was excellent. Even if he had been on an IFR flight plan, he would still be required to maintain separation from VFR traffic, and maintain his altitude. I am positive that I was no lower than 5,400 feet at the time."

U-8D

"During a flight in IFR weather, under conditions of moderate ice and severe turbulence, two unsuccessful landing approaches were made. Clearance was given to an alternate field and the aircraft was placed in a climb to the designated altitude. Propeller anti-icing equipment was on, de-icing boots were pulsating continuously, and carburetor air temperature was maintained at 45° C. As assigned altitude was approached, the pilot suddenly pointed to the airspeed indicator, which dropped rapidly to below 80 knots. The copilot immediately grabbed the controls and firewalled both props and throttles. Airspeed failed to increase — UNTIL PITOT HEAT WAS APPLIED."



O-1E

"Shortly after our base started participating in the Engine Analysis Program, our unit received a call from the laboratory at Fort Rucker informing us that excessive aluminum and iron particles were found in one of our oil samples. As a result, our field maintenance shop performed a spectroscopic anaylsis of the engine in question and found a defective cylinder. We feel that this program prevented an engine failure during flight."

U-8D

"The top latch of the entrance door popped open during an instrument departure. We immediately requested an approach from departure control. The airfield was reporting 1¼ miles visibility in haze and the controller attempted to put us on downwind for landing. The field was not visible from downwind, so the controller continued to vector us to a position on final approach at 1,000 feet. We started our descent when he gave our position as 2 miles. The ground came in sight at 500 feet when we were approximately one-third the way down the runway. We continued the descent to 300 feet, but it became apparent there wasn't enough runway remaining and I applied climb power and circled to a position for landing. Although this landing was made without incident, several mistakes could have easily compounded to create an accident:

"1. The controller assumed we were VFR, although we were on an IFR clearance.

"2. We accepted his vectors for a VFR landing instead of insisting on an instrument approach, even though the approach was all set up on the radios and the approach plate was handy.

"3. Excessive concentration in our attempt to locate the runway diverted our attention from aircraft control and resulted in low airspeed at low altitude."

CV-2

"Our aircraft encountered moderate to heavy icing at 8,000 feet during a night IFR flight. This was the minimum en route altitude, so the center could not give us a lower altitude. Within 2 minutes, over 2 inches of ice accumulated on all surfaces. Our airspeed dropped from 140 to 105 (indicated). We held our altitude with climb power settings. No hazard was experienced — it is just nice to know that the CV-2 can fly with heavy ice loads."

OH-23

"I was supporting a field exercise on a clear day after two days of heavy rain. The temperature was about 20°F. When I attempted to crank up, I found the throttle frozen. There was no Herman Nelson or other means of heat available, so I located some hot water and poured it over the throttle cable to thaw it out. The cable thawed quickly and I took off for an airport 15 miles away. Halfway there, the throttle froze again at cruise power. I notified the tower and advised that I was going to make a pass over the runway to see if I could hover with that power. They got out the crash crew and I started my run. After my third flare, the throttle broke loose.

"I was unable to make an approach to a hover because of the excess power, and I didn't want to autorotate for two reasons: (1) I had flown less than 10 hours in helicopters during the past 11 months, and (2) I doubted whether I could move my hand from the mag switch to the collective fast enough to avoid losing rotor rpm.

"I think the cold air passing over the cable in flight caused the throttle to freeze again. If I had brought the chopper to a hover for a short time (even at the altitude the power would have required), I think the heat from the engine would have thawed the cable."

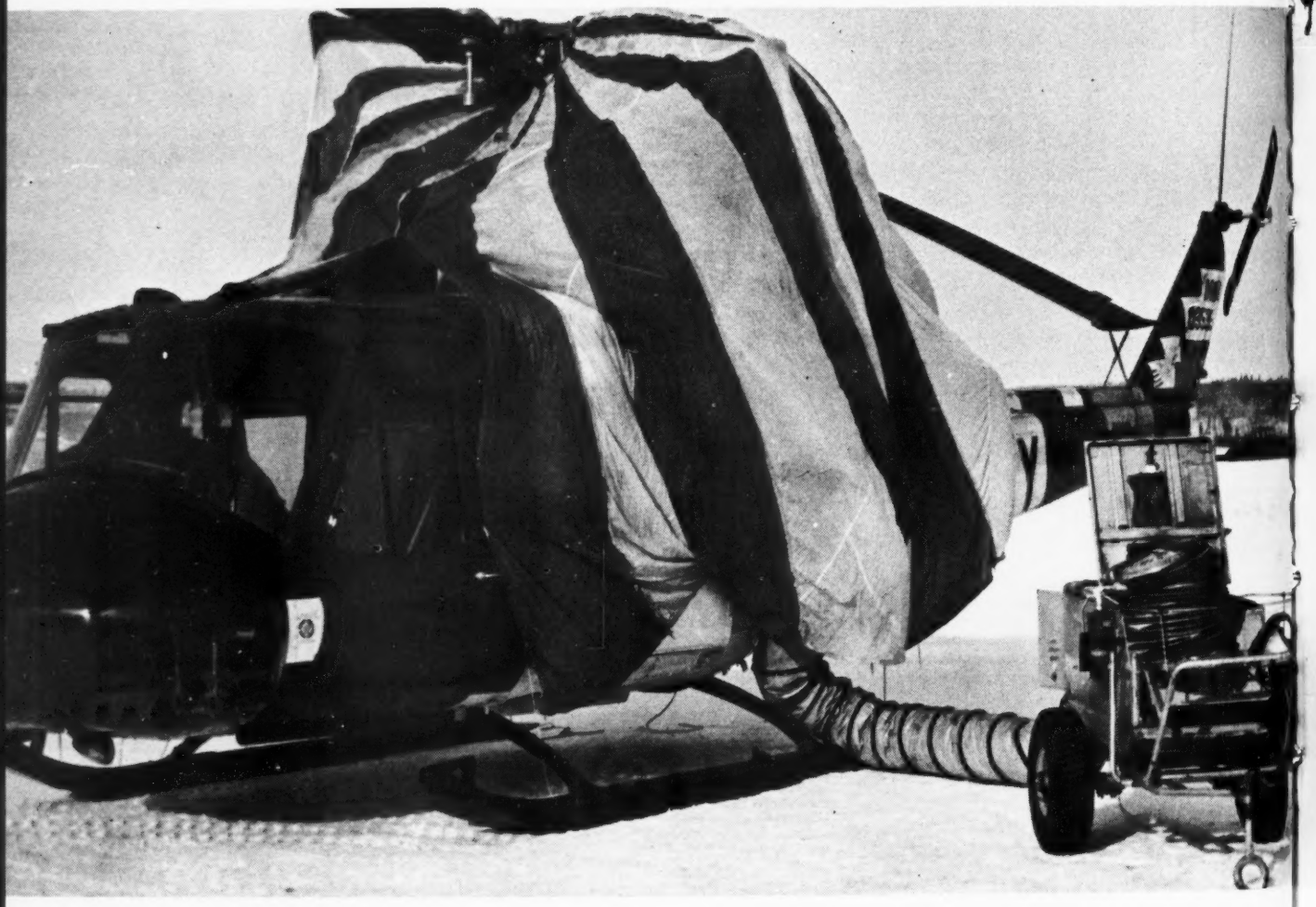
U-6A

"I was shooting touch and go landings at night. As I reached for the flaps on final, my hand scraped past the cotter pin retaining the bolt on the pilot's seat belt where it is attached to the seat. I sliced my hand open and should have had some stitches in it. I suggest doing away with cotter pins in this location and substituting safety nuts with no sharp edges. The aircraft I was flying happened to be the only U-6 on the field with the cotter pin. The rest had safety nuts."

Cold weather operators should file this effective, low-cost field expedient maintenance shelter idea under "future reference."

Economical Cold W

MEMBERS OF the Maintenance Section, Yukon Detachment, USARAL Aviation Battalion, Fort Wainwright, Alaska, have developed a field expedient type maintenance shelter. The shelter consists of one salvaged parachute and one Herman Nelson heater with one large heating duct. This type shelter was used by this unit during Exercise Polar Siege with a great deal of success. This shelter has been tested in sub-arctic temperatures of –40° F. It has been found that at temperatures as low as–30° F, a man using this type shelter can work in a tee shirt. The white panels in the parachute let in enough light during daylight hours to preclude the use of artificial lighting.



Cold Weather Maintenance Shelter

Winterized Whirlybird

PARTICIPATING IN winter maneuvers at Fort Greeley, Alaska, 33 fully equipped arctic combat troops line up alongside a CH-47A Chinook helicopter.

Equipped with special skis on the fore and aft landing gear, the Chinook flew the troops and their arctic equipment on simulated combat missions in temperatures ranging down to 50 degrees below zero.

The skis are molded of fiberglas and are mounted high enough that the wheels still function normally on bare surfaces. On snow or marshy ground, the skis provide plenty of footprint area to keep the helicopter from sinking in. They are especially useful for running landings in dry snow.

— Boeing Release and Photo

Buffalo makes maiden flight

THE DE HAVILLAND Buffalo (Army CV-7) made its first flight on April 9. The first hop lasted over one hour and the chief test pilot reported excellent handling qualities and flight characteristics.

Designed for employment as a tactical military transport under all-weather conditions in areas where short, rough, unprepared strips provide the only takeoff and landing surfaces, it features exceptional low, slow flying controllability. This feature makes it particularly suitable for military application when fast and accurate paradropping of troops and supplies is desired.

The Buffalo is powered by two G.E. T64 (2850 E.S.H.P.) turbine engines and Hamilton Standard reversible pitch propellers. It will take off to clear a 50-foot obstacle in less than 1,000 feet and land in approximately the same distance.

The Buffalo accommodates payloads of over 5 tons and seats up to 41 fully equipped troops, 35 paratroops or 24 litters and 6 seats. Its general dimensions, coupled with a rear loading door and adjustable ramp facilities, permit fast loading and unloading of bulky cargoes, vehicles and machinery.

The CV-7 has a cruising range of over 1,300 miles. The installation of long-range ferry tanks increases its range to over 3,000 miles, permitting the speedy deployment of the aircraft anywhere in the world.

The DHC-5 Buffalo was initially designated the Caribou MK. II. It is in fact an advanced version of the Caribou MK. I, adding the turbine power advantages of improved performance, economy and greater payload capability.

The aircraft is scheduled for delivery to the United States Army early in 1965 to commence evaluation of its application to the military transport role.

— de Havilland News Release

USAAVNTBD Gets Turbine-Powered Seminole

THE U. S. ARMY Aviation Test Board, Fort Rucker, Ala., has received the first turbine-powered U-8F Seminole aircraft.

Designated the NU-8F, the six-passenger, twin-turboprop is scheduled for a comprehensive three-month user evaluation. It then will be placed into regular Army service. The NU-8F is powered by Pratt & Whitney PT6A-6 engines.

— Beech release and photo.